The UNESCO Courier

A window open on the world

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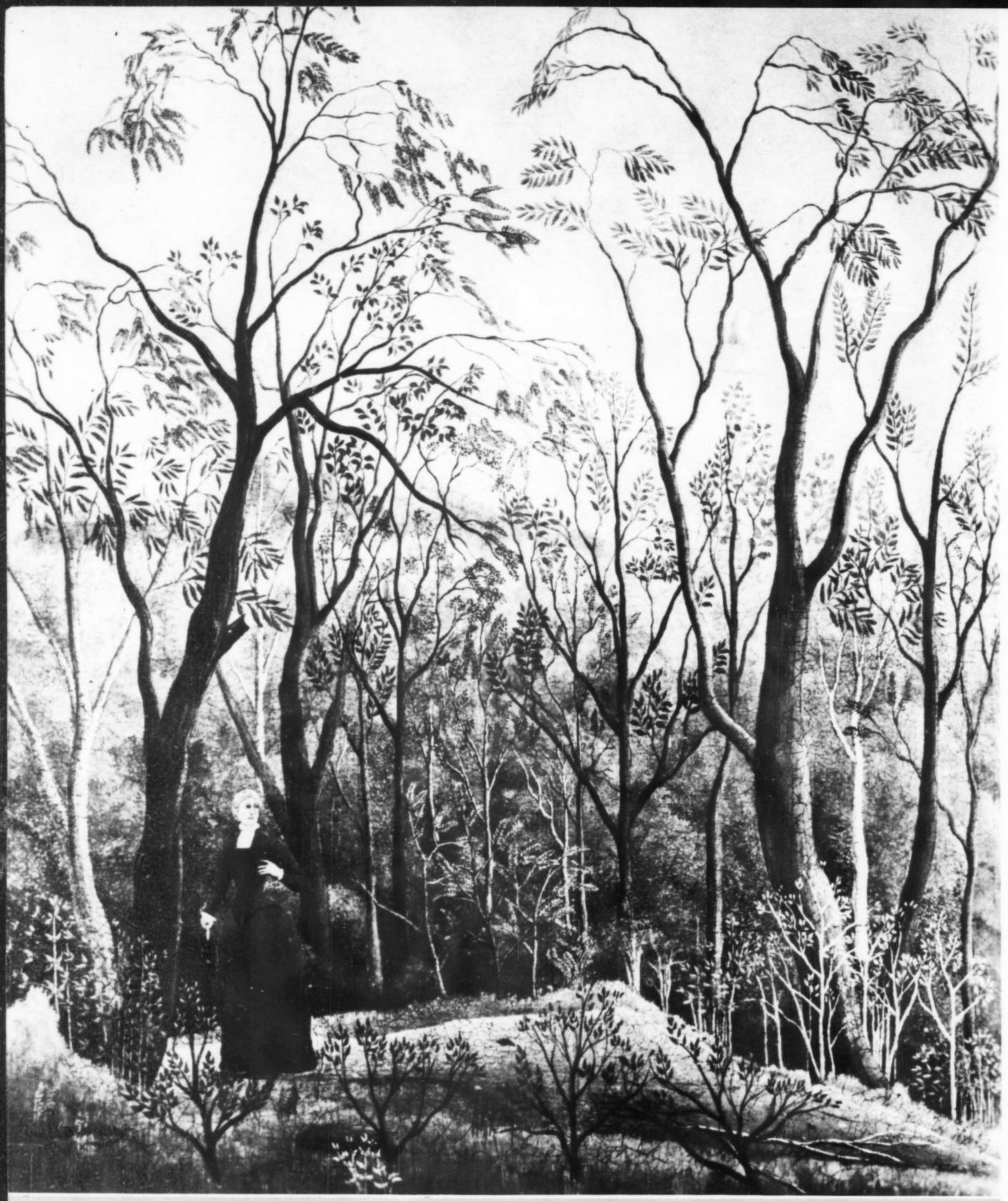
NOISE POLLUTION



TREASURES OF WORLD ART

18

Nostalgia for nature

A nostalgia for placid pools and wild foliage haunts the landscapes of Henri Rousseau (1844-1910) called the douanier, **from his profession of customs official. He painted this work, "In the Forest" (Zurich Museum, Switzerland) in 1886. That year, Rousseau, a self-taught, "week-end" painter exhibited his works for the first time at the Paris** Salon des Indépendants. **Within a few years, poets and painters were hailing the primitive yet modern qualities of Rousseau's painting.**

"Catalogue of Colour Reproductions of Paintings" (1860-1965). Unesco, Paris. Phototypie colour reproduction, 55×47 cm. The Pallas Gallery Ltd., London, £2.2.0.

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Nostalgia for nature (Henry Rousseau)

Photo © Walter Studer, Bern

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Cover photo

Noise is one of the scourges of the modern world, an unwanted product of our technological civilization increasingly polluting our daily life. To the din that assails us in streets, offices and factories and even our homes, a new noise will soon be added: the reverberating boom of supersonic jet airliners. We are paying, in nervous strain, noise-induced deafness and other physical and mental ills, the price of faster transport and an "easier" life. Yet ways can be found to halt the noise invasion and mitigate its harmful effects.

DOWN WITH DECIBELS !

This view of the unending stream of traffic on the Avenue des Champs Elysées in Paris hardly suggests the peace and repose of Elysium, the paradise of Greek mythology, after which the avenue is named.

Photo © Francisco Hidalgo - Fotogram

by O. Schenker-Sprüngli

NOISE has always been with us, but never has it been so obvious, so intense, so varied and so pervasive as it is today.

Modern life has been made easier by numerous technological innovations, but some of the side-effects make progress as a whole seem problematical and indeed, in some respects more like regression. In addition to the serious problems of air pollution and water pollution we now have to contend with "noise pollution" in many forms.

Unlike the lucky few who can spend their lives far from the clamour of our technological age, most people, at least in industrial areas, are obliged to live and work under conditions in which noise often attains an alarming level. In the home, children are unable to sleep or are suddenly aroused by the roar of a passing aircraft or the din of a noisily revving automobile.

Older people also suffer from these disturbances. Deprived of a proper night's sleep in a well-ventilated room, many people are unable to recuperate the physical and mental energy they have used up at work and will need again next day. They try to shut out noise by keeping windows closed or wearing ear plugs. And even then they cannot be sure of sleeping undisturbed.

Next morning they have to face another day of hard work, often in noisy surroundings, which means that more nervous energy is burned up in resisting the stress of no se, instead of being used productively.

Insufficient rest and relaxation inevitably reduce efficiency. Noise, in fact, causes an incalculable loss of nervous energy to the detriment of the health and well-being of the individual and ultimately to the detriment of the national economy as a whole.

Although these facts have been confirmed by studies and research in Switzerland and many other countries, a few people still maintain that until noise "has turned a grey mouse into a white one", all that has been affirmed about the effects of noise is merely theoretical and therefore inconclusive.

Such persons are merely side-tracking the problem. It is just as though the painstaking research on noise that has been going on over the past ten years, leading in each case to identical conclusions, has been a complete waste of time.

Yet anyone who observes present-day conditions of life not only in our cities, but increasingly in the countryside too, can see for himself the direct and indirect effects of incessant noise on modern man: nervous troubles, reduced powers of concentration, inefficient work, increasing absenteeism, among others.

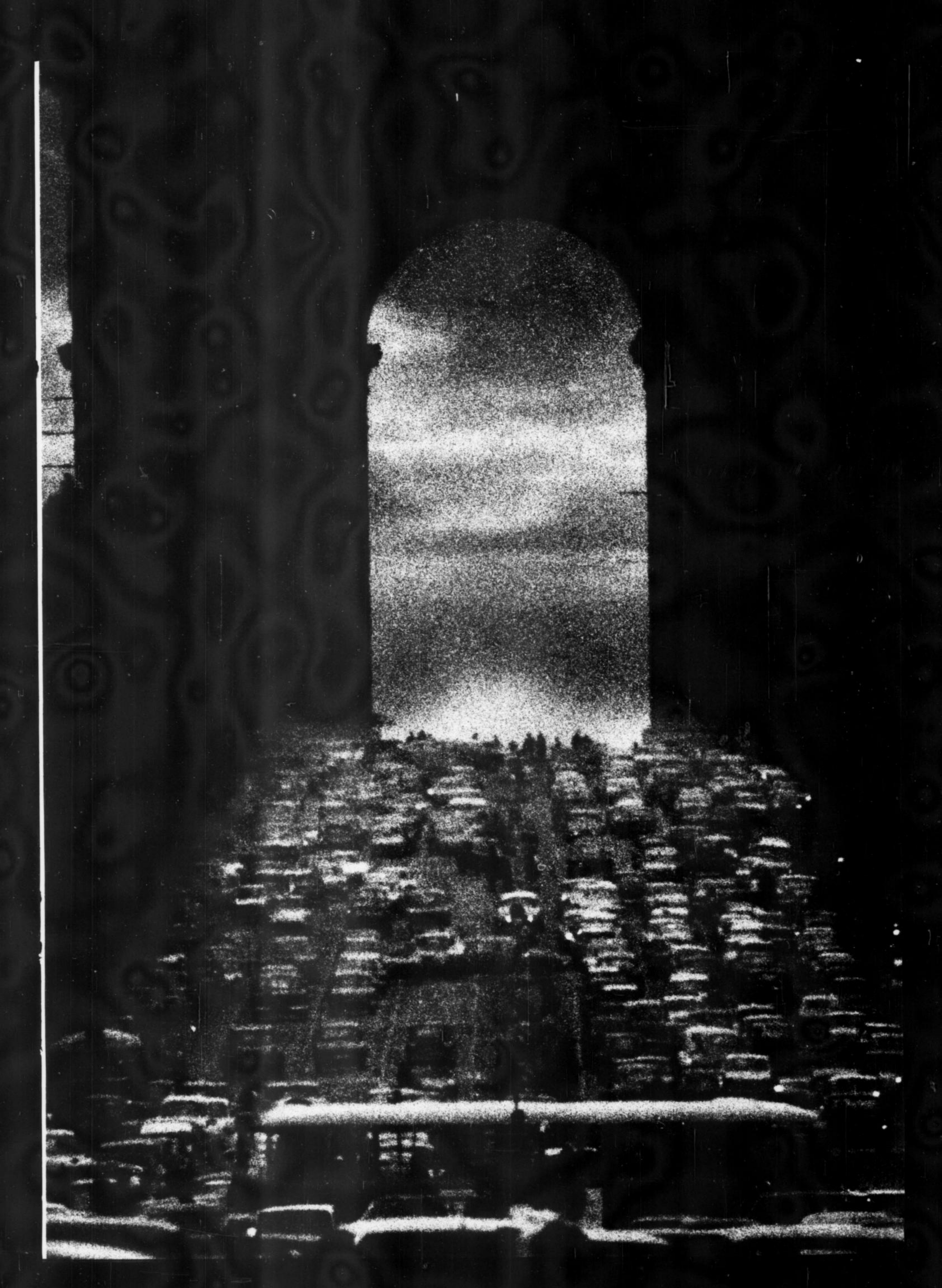
These few examples give us a general idea of the present state of affairs. How did we come to be in such a situation? Primarily because social and legal measures were not taken to prevent it, and for the failure to act in time the public authorities bear the major responsibility. For far too long the spread of noise was accepted as a natural process, as a price to be paid for our technological progress. Law, justice and public authorities all capitulated to technology.

In such a situation the average person tended to feel, and to become, helpless. The first wave of protests gave way to resignation. People shrugged their shoulders and said "There's nothing we can do about it".

But just over ten years ago organizations were set up in a number of European countries to wage campaigns against the spread of noise. These bodies, whose organizers were often eminent doctors, jurists, engineers and specialists in acoustics, decided to unite their action and in 1959 formed the International Association Against Noise. The Association has so far held four important congresses on noise abatement (Zurich, 1960; Salzburg, 1962; Paris, 1964 ; Baden-Baden,

CONTINUED ON PAGE 6

O. SCHENKER-SPRÜNGLI *of Switzerland is Secretary-General of the International Association Against Noise. A lawyer by profession, he is director of the Swiss Anti-Noise League.*



The growing anti-noise movement

1966) and will hold its fifth congress in London early next year.

It is all very well to set up organizations and hold congresses and meetings in different countries but what practical results have been achieved by all this? Here are a few examples:

■ By stimulating new activities, meetings and congresses have given an impetus to basic research and have promoted progress, often of outstanding value. But it obviously takes more than a few years to eliminate even the major part of all the noise that has been accumulated by the unbridled expansion of technology over several decades. Achievements during the past ten years in acoustics, sound-proofing techniques and the introduction of anti-noise regulations have nevertheless been remarkable.

■ Each of the congresses of the International Association Against Noise has enabled over 500 specialists to exchange ideas, pool their experience and establish fruitful contacts on both the personal and scientific levels.

■ Since its foundation and especially on the occasion of its four congresses the Association has established contacts with major international organizations, including the United Nations Office in Geneva, the World Health Organization, the Council of Europe, the European Conference of Ministers of Transport and the International Organizations for Standardization. It also works closely with other organizations concerned with anti-noise campaigns, and its specialists are frequently consulted on major problems and decisions in the field of noise abatement.

■ Since its directorate has always comprised a physician, an engineer, a specialist in acoustics and two jurists, the International Association is in a position to give prompt and authoritative opinions on questions of international scope within its field.

If the problem of noise is to be resolved several factors will have to be kept constantly in mind:

Although the campaign against noise is a global problem, its starting point must be the individual. An individual effort to overcome egotism is a prerequisite of any collective anti-noise campaign. Anyone unable to make this effort of self-restraint and incapable of recognizing the real meaning of technical creativity, is already a victim of the technological era along with its unwanted products: noise and the pollution of air and water.

Noise and reflection are mutually exclusive. Noise is an obstacle to brainwork and can easily disrupt a vital train of thought.

It would be wrong to blame technology for all the noise, past and present, that has afflicted man. Technology as such is neither good nor bad. It is the men behind it who are responsible for noise, and it is for them to seek the remedies. As Professor Gunther Lehmann, President of the International Association Against Noise has said, "Noise is not a measure of the progress of technology, but a sign of regression".

When it comes to doing something practical about excessive noise, it is clear that most people are unwilling to take the initiative. Noise can be tackled with some hope of success only with the backing of public opinion and proper laws and regulations. Law-making is therefore a vital factor in anti-noise campaigns.

But laws are effective only when they are rigorously enforced. And public interest in anti-noise campaigns usually needs arousing, since many people, even the well-educated, fail to realize the harm that permanent and excessive noise can do to the human organism.

To stimulate this interest, effective public information campaigns are needed, based on the authoritative scientific data collected in the past ten years by national and international bodies, whose members include many distinguished specialists.

'NOISE BAROMETER'

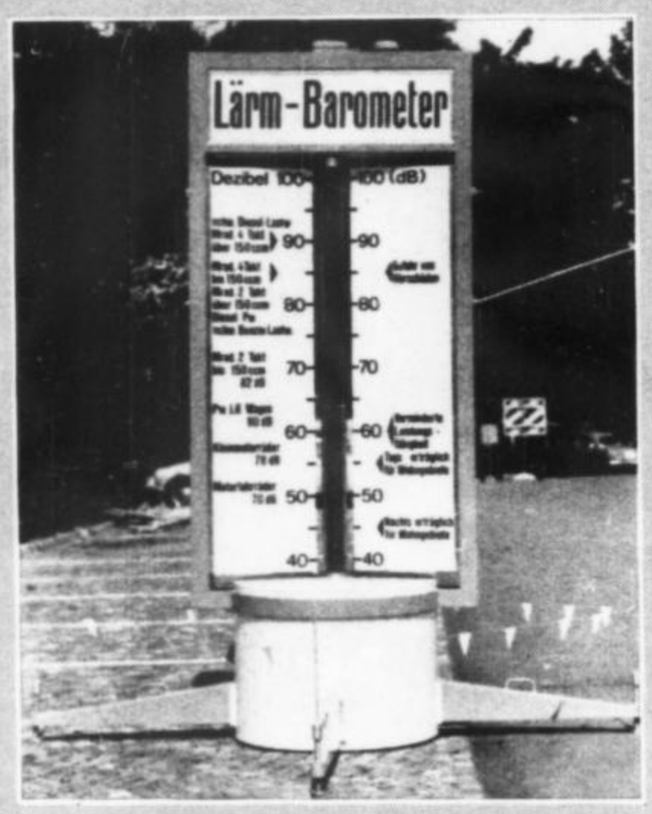


Photo-WHO

On a scale graduated in decibels, this "noise barometer" in a street in Zurich (Switzerland) shows passers-by how much noise nearby traffic is making. The decibel is a unit used to measure different intensities of sound and is calculated from the level at which sound becomes audible to the human ear. But neither the subjective impression of noise perceived by the ear nor the degree of disturbance it causes can be measured with precision on the decibel scale. The 50-decibel change of intensity between the noise of people conversing and the rustling of leaves (see scale, left) is far less noticeable than the 50-decibel gap between the same conversation and the noise of a jet engine. High frequency (high-pitched) sounds grate on the ear more than those with a low pitch.

Noise levels in decibels

- 130 — Riveting
- 120 — Threshold of pain
- 110 — Jet aircraft (at 100 yards)
- 90 — Sports car, Heavy lorry
- 80 — Motorcycle, motor-scooter
- 70 — Busy street
- 60 — Conversation
- 50 — Quiet street
- 40 — Quiet room
- 30 — Tick of watch (at 1 metre)
- 20 — Whisper
- 10 — Leaves rustling in the wind
- 0 — Threshold of audibility

Sound echos down a narrow street as youngsters speed along on motorized bicycles. A sign of youthful high spirits, perhaps, but disturbing for the neighbourhood. According to some studies, one reason why teen-agers enjoy making so much noise with motorscooters and similar vehicles is that it gives them a feeling of power.

Photo IPN - Suquet-Allard

One example is the report submitted to the Swiss Government in 1963 by specialists in the Swiss Federal Anti-Noise Commission. Its conclusions, by the way, agree with those presented to the U.K. Parliamant the same year by the British Committee on the Problem of Noise.

The Swiss Anti-Noise Commission is composed of 52 specialists and its studies and research are carried out by five sub-commissions dealing with basic medical, acoustic and technical questions; road, rail, sea and river traffic; aircraft noise; noise in industry, building construction, homes etc; and legal questions.

Their work has enabled encouraging progress to be made in Switzerland. Public indifference to the increase of noise is gradually disappearing. More vigorous legal and administrative action is being taken against persons failing to comply with noise regulations. An official research, testing and advisory centre (the Acoustics and Anti-Noise Division of the Federal Materials Testing Institute, af Dübendorf, near Zurich) has been set up.

The "maximum noise level" scales established by the Swiss Anti-Noise Commission have also been of great value (see below).

Figures are given in decibels (dB, the measurement unit for noise). A level of 80-85 dB is what is normally expected from the continuous noise in a busy main street of a large city. These maximum noise levels have been accepted by the Swiss courts.

Like those already in force for automobiles in many countries, the Swiss maximum noise levels are easier to enforce nowadays thanks to technical advances in noise prevention during the past ten years.

In building construction, for example, relatively silent machines have taken over the job of foundation digging from the far noiser pile-divers, electro-mechanical drills replace the clattering compressed-air variety and special screens now absorb the din of compressors.

Automobile noises can be reduced by the more effective exhaust mufflers now available and also by non-slam doors and boot lids.

Much can be done to reduce the din of aircraft. Already some have been fitted with silencers and further improvement has come from the installation at airports of acoustic check posts and sound-proofed hangars for testing engines. The enforcement of stricter flying regulations has also played its part.

Sound absorbing materials, drapes, curtains and carpets which deaden noise, quieter air-conditioners, ventilators and other household appliances, and sound-insulated ceilings, walls, doors and windows all help to make the home a quieter and more restful place.

Combating noise is above all a question of showing consideration for others and of the right kind of upbringing. It thus has to begin in the home as part of the education of children and adolescents.

To sum up, it seems certain that our present understanding of the problem of noise coupled with our technical knowledge and resources now give us the means to bar the way to disturbances from noise. But those who undertake this task will need great courage and determination, since many people still fail to recognize the real importance of anti-noise campaigns, especially those who rate technical progress higher than ethical values.

A current example of this attitude is the effort now being made by the aeronautical industry to pursuade us that we shall enjoy the din of supersonic airliners. Public relations machinery and techniques are working on an unsuspecting public with the slogan "learn to live with the boom". But booms and bangs are incompatible with daily life. Anyone who cannot see this is gambling with nature, instead of living in harmony with it.

MAXIMUM NOISE LEVELS

(in decibels)

Established by the Swiss Anti-Noise Commission

Areas	*Basic sound* night	day	*Frequent peaks* night	day	*Infrequent peaks* night	day
Recreational	35	45	45	50	55	55
Residential	45	55	55	65	65	70
Mixed	45	60	55	70	65	75
Commercial	50	60	60	70	65	75
Industrial	55	65	60	75	70	80
Main Traffic arteries	60	70	70	80	80	90

THE ARCHITECTS OF SILENCE

by Constantin Stramentov

In the construction of many modern buildings, too little attention is paid to the problem of excluding city noises and those that echo from floor to floor within the building. Yet effective sound-proofing techniques exist and in many countries organizations have been set up to encourage their use and improve their efficiency. It is up to town planners, architects, local authorities and city dwellers to insist on the use of proper sound proofing so as to make the home a peaceful refuge from the rush, bustle and noise of modern life.

Photo © Fotogram - A. Varge

DO we need absolute silence? Those who have ever remained for any time in a sound-proof chamber know what a horrifying experience it is. Absolute silence is contrary to nature, an artificial creation of our century. All of us at one time or another have described a particularly intense silence as "terrifying".

It is easy to imagine how dangerous a completely silent car would be. It would cause far more serious trouble than the disturbing throb of its engine, which our ear associates spontaneously with the approach of danger. Surprisingly then, noise has the dual character of being both harmful and useful.

When they produced that noisy plaything, the automobile, for man's gratification, Daimler and Benz certainly never suspected that their gift was to be, in a sense, the Trojan horse of our civilization. We are now paying a high price for the satisfaction of having faster ways of transport: we have to live constantly with the infernal din of motor traffic. Once again, as so often happens, man is the victim of progress, the slave of his own invention.

So harmful is noise that it can sometimes kill. The hooting of a car symbolizes this mortal danger. The noise made by a motor horn two yards away is estimated at 95-100 phons. It has been established that man's visual reaction drops by 25% when the noise level rises to 90 phons. The possible consequences of this need no elaboration.

What, in fact, we are combating is not so much noise as such (in acoustics, all sounds are termed noise) as its dual character. We are trying to abolish noises that are harmful to human beings, but not to get rid of all noises, since this would deprive man of a vital source of information. Radio,

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CONSTANTIN STRAMENTOV *of the U.S.S.R. is an architect specializing in town planning. He has written many studies on urban development, particularly on arrangements for road traffic and the control of noise in cities.*

Absolute silence is no more welcome than uproar. Anyone shut inside the sound-proof chamber of an acoustics laboratory (below) quickly becomes disturbed by slight sounds such as the beating of his heart and pulse, his breathing and even the movement of his eyelashes. These normally imperceptible noises are heard with an intensity that would produce serious psychological effects on anyone who stayed in the chamber for long.

Photo © Paul Almasy, Paris

Using noise to cancel out noise

Photo © Omnia, Bern

for instance, is a useful noise, while music is simply a pleasant one.

In this article we shall often use the word "phon" so it would perhaps be as well to explain briefly what is meant by the measurement of sound.

The physical unit for measuring the intensity of sound is the decibel. But the number of decibels does not give us a precise idea of the receptivity of the human ear. So we also have to use a physiological unit, corresponding to the subjective perception of sound by the average human ear. This unit is the "phon".

The phon is the smallest variation of sound perceptible to the human ear. And the range of audible sounds between the threshold of audibility and the point at which sound causes pain is generally estimated as 120 phons.

The twentieth century has been marked by the relentless invasion of noise into everyday life. Yet no city deserves to be called "modern" so long as the sleep of its citizens is disturbed by the rumble of passing trucks. In the daytime conditions are different and the infernal roar of thousands of automobiles crowding our streets and highways scarcely bothers us at all.

It has become so familiar that it seems to be merely a drone in the background, especially since the increase in noise from year to year has been fairly slow, as though to give us time to become accustomed to it. But now, in the 1960s, it has attained a level of 80 phons on our main thoroughfares. Here, to give a better idea of what this represents, are some figures for other sounds:

rustling grass	10 phons
noise inside a light vehicle	35-55 phons
normal noise inside a house	40-50 phons
a moving tram	70 phons
motor cycle with silencer	90 phons
pneumatic hammer at a distance of 30 feet..	100 phons

To take an extreme example, there is the sad story of the metal pail which was left by mistake inside a room used for testing jet engines. Within a certain time it had completely disintegrated due to the sound vibrations set up by the roaring engines.

Another point to remember is that the range of sounds perceptible to the human ear is relatively limited. On either side of this spectrum are infra-sounds and ultra-sounds that we do not perceive. And tests have shown that inaudible noise, like an invisible enemy, is even more deadly than the noise we hear. However, enemy No. 1 is still the noise within the 0 to 120 phon spectrum.

James Watt (1736-1819) the British engineer, once rightly remarked that to uneducated persons noise is suggestive of power. A machine which operates silently or without vibration is obviously far less impressive than a noisy one.

Some people still imagine that the more noise there is, the more work is being done. But tests made in post offices, for instance, showed that when noise increased from 75 to 95 decibels, productivity immediately dropped by 25 per cent, and mistakes made in sorting mail increased four-fold. Acousticians then placed sound-deadening screens between the employees, reducing noise by between four and five decibels, and even this small reduction raised productivity by 5 per cent. When noise was further reduced by between 10 and 15 decibels, productivity rose by 18 per cent.

The familiar exclamation, "Don't make a noise", or "Quiet please" can be translated into scientific terminology as follows: "My work demands great concentration and I must therefore preserve the connective functions of my cerebral cortex. I cannot afford to weaken the inhibitory processes and I have to preserve the working capacity of my nervous system."

Research of various kinds as well as statistics show the harm caused by noise as:

Photo © Omnia, Bern

STRAINED EXPRESSION of pedestrian in this busy street is one symptom of noise fatigue. Not enough is known about the extent of the psychological and physical ills caused by the incessant noise to which many people are exposed at work, in the street and at home. But studies now suggest that their effects are more serious than was realized.

BOOMERANG EFFECT. Improved techniques in industry have reduced the need for manual labour and speeded up many kinds of work. But along with power, machines produce noise and this provokes new forms of fatigue and an increased risk of occupational ills such as deafness. Left, the air-hammer, being used here to tamp down earth, is one of the worst noise culprits.

MODEL 'TOWNS' are used by Soviet city planners and acoustics specialists to solve noise problems of cities now abuilding or being planned. Below noise measurements are made on one of these models. Residential areas are "insulated" from a main highway by a series of non-residential buildings seen on right of photo.

- a frequent cause of street accidents and mishaps at work
- the source of disorders of the nervous system
- responsible for hearing losses of varying degrees
- inimical to working efficiency

The campaign against noise cannot be waged in isolation. The biggest source of noise is transport (at least in towns) and town-planners and acousticians everywhere are confronted with more or less the same problems.

In the Soviet Union the anti-noise campaign is being promoted on three fronts:

- in hygiene and public health, through studies of industrial working conditions, research into the effects of noise on human beings and the enforcement of noise control measures;
- in architectural planning, through the use of more rational layouts for towns and built-up areas, and building and architectural studies, including research into new methods of sound-proofing houses;
- in technology, through the development of new muffling techniques and the manufacture of more efficient sound-proofing materials.

In modern industrial planning, in metallurgy for instance, noise levels often influence the design of a factory, the various departments being arranged according to the intensity of noise they are likely to produce. The noiser the workshop, the more massive the noise insulating walls around it and the more complex the screening devices. In some cases operations are supervised from observation posts. Other arrangements to reduce the effects of noise include remote-control posts, closed-circuit television and special rest rooms for workers.

Rolling mills are always controlled from completely sound-proof cabins. Workshops for assembling and testing engines, where the noise cannot be stifled at source, are isolated by heavy screens and test benches are operated automatically by remote control.

In the U.S.S.R. action has been taken against abusive noise on a broad administrative front. Regulations forbid the use of certain vehicles on specified routes and of noisy vehicles at night. In August 1956 the use of motor horns was made illegal in Moscow and the noise level in the streets immediately dropped by eight to ten phons. Since then the steady increase in traffic has to some extent cancelled out the beneficial effects of this regulation.

In our age of specialization, a new technician has appeared in the field of town planning and construction: the expert who deals with the practical problems of acoustics. Architects, builders and acousticians now cooperate in planning how best to use our urban living space.

To reconcile all the factors involved is not easy. Controversies arise between constructors and acousticians on the one hand and automobile industry engineers on the other. It has also been found that modern architecture does not always satisfy the needs of acoustics. The vast, flat surfaces of modern buildings, it appears, are acoustically less suitable for cities than the tortuous carved stone of "Baroque" architecture which diverts noise and rapidly reduces its intensity.

Squares are usually thought to be the noisiest places in a town, yet tests show surprisingly that they are less noisy than streets. City streets may be likened to canals, with houses acting as walls, between which all sounds continue to reverberate until they finally die out. In squares the extra space helps to disperse the sound waves which are also absorbed by trees and gardens.

Ideally, noise should be eliminated

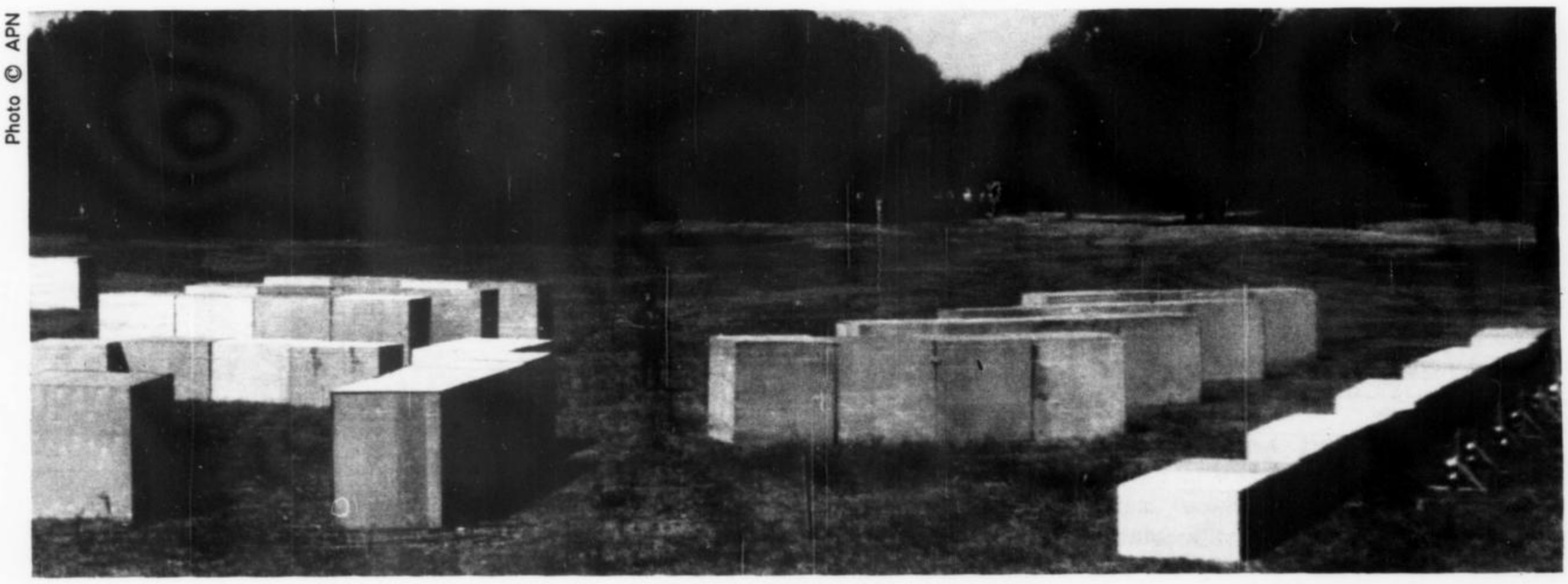


Photo © APN

at its source, but this is not yet practicable, so for the moment efforts are made to localize it by every means.

A miniature town, for testing techniques designed to eliminate the scourge of modern city noise, has been built on the banks of the Volga River. The sources of urban noise re-created in this artificial city provide researchers with reliable data on which to work and conditions in which the vulnerable points can be identified.

Town planning in the Soviet Union complies strictly with the principle of separating industrial and residential areas, and in this way city dwellers are spared the harassment of excessive noise.

Satellite towns without factories have also been built and town planning methods devised to reduce the volume of noise, particularly by adapting the design of main streets to the needs of the buildings flanking them.

Reconstruction and renovation of cities offer opportunities for eliminating or reducing many sources of noise. Green spaces and protective screens are incorporated in street designs so as to surround buildings with a "wall of silence".

Such solutions, with the exception of the planting of trees, can hardly be said to improve the appearance of a town. The acoustician, working in this case not with the architect but in opposition to him, conceals the buildings behind a screen. So what is there left for the architect to do except to seal the windows hermetically and use thicker panes. And that implies the installation of air-conditioning—itself a source of noise.

So the answer is to reach a compromise. The appearance of a town cannot be sacrificed to meet the demands of acoustics, yet acoustics must be taken into account for the sake of the health and tranquility of the inhabitants.

Some people are always hopeful that a scientific innovation will come along to solve the problem. Physicists, for instance, propose using one evil to suppress another. As an antidote to noise they suggest using electronic apparatus whose loud speakers would emit sound waves with oscillations of the same amplitude as that of the unwanted noise, but in inverse phase. The resulting interference, they say, would wipe out the noise.

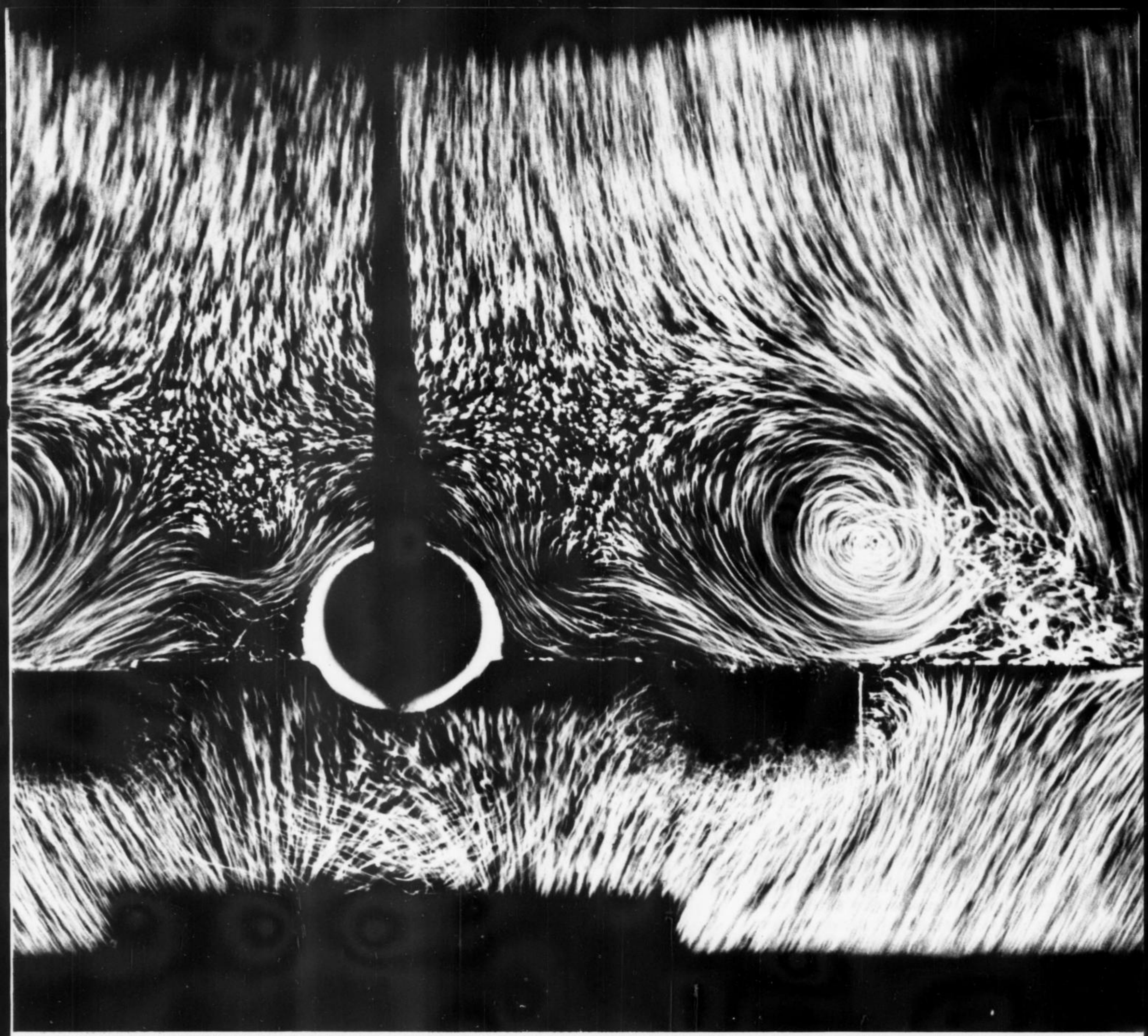
Whatever methods are used, the "music" of town noises has to be rewritten completely and rendered, if not truly harmonious, at least acceptable to the human ear.

With supersonic commercial airliners designed for speeds up to 1,800 m.p.h. (2.7 times the speed of sound) now on drawing boards or already in prototype construction, the day is not far off when millions of people will be faced with the problem of sonic booms. This striking photo was taken during wind tunnel tests on a model of the Anglo-French supersonic transport "Concorde" (designed to fly at 1,450 m.p.h.). It shows the flow of air that will swirl around the aircraft (viewed from rear) as it comes in to land.

Photo Sud Aviation, France

STREET AND AIR TRAFFIC NOISE— AND WHAT WE CAN DO ABOUT IT

by Léo L. Beranek



NOISE once served as man's principal warning signal. The sound of an approaching carriage on an otherwise quiet street warned people of danger. A booming sound meant an explosion, often accompanied by disaster. A noisy bearing or a shrieking cutting tool signaled mechanical failure in the factory. The piercing shout of a fellow worker was a prime factor in preservation of life on a construction job.

Historically, noise has been a servant to man. But in the last quarter century, noise has fallen from a position of usefulness to one of nuisance. Modern technology has furnished its own fanfare—an ever-increasing din that disturbs our sleep, interrupts our conversation, creates anxiety and annoyance, and sometimes damages hearing.

Advancing civilizations will create more noise, not less. Of that, we are certain. In all probability, the noise level will grow not only in urban centres, but, with increasing population and the proliferation of machines, noise will invade the few remaining havens of silence in the world. A century from now, when a man wants to escape to a quiet spot, there may be no place left to go.

We probably could not reverse the trend, even if we tried; so we must view the problem not as one of eliminating noise, but rather of controlling it. Science alone is not the answer. Our most troublesome noise problems carry price tags; economic considerations must be weighed against people's desire for culture and "the good life."

As in any democratic process, the balance is struck in the political arena. The people's well-being must be squared with preserving a good educational

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One truck twice as noisy as a steady flow of cars

system, with maintaining a reasonable tax rate, and with guarding the nation's position in the marketplace of the world. The science, economics, and politics of several of our most important noise problems are the subjects of this paper.

Sensational stories of the effects of loud noises on the well-being of man are often printed in the popular press. The noises of daily life have been blamed for increases in the divorce rate, social conflict, indigestion, inability to perform tasks with the limbs, or eyes, nervous breakdowns, high blood pressure, heart failure, and even insanity.

Most of these allegations are the products of vivid imaginations. Of course, one cannot rule out the possibility that a few people are particularly sensitive to noise, just as some are allergic to nuts, eggs, or ordinary dust. But controlled social observations have indicated that the most important biological effects of loud noises are: hearing impairment; interference with speech communication; interference *by distraction* with mental or skill work; interference with sleep; and a feeling of general annoyance.

SURVEYS conducted in Central London, near London airport, and in several American cities both near and far from military air bases have revealed some interesting statistics. Of the thousands of people interviewed, about one-fourth of those present in *any stratum of noise intensity* seem to be unperturbed by their noise environment.

These people apparently could and often do live happily next to elevated train routes, trucking routes, aircraft flight paths, or other very noisy activities. About a tenth of those interviewed seem to be disturbed by most any audible noise not of their own making, regardless of level. These same people were dissatisfied with many other things in their environment.

It appears that fear of safety for children near traffic routes and fear of air crashes increases people's sensitivity to these respective types of noise. Personal differences owing to age, sex, income, education, occupation, and so forth, do not seem to be very significant. Of those in areas with a specific loud noise, about one-third said that they tend to get used to the noise, while about one-fourth said they are bothered more by the noise as time goes on.

Carefully controlled tests performed in laboratories and with pilots of aircraft indicate that noise alone does not affect people's ability to reason, to do mathematical exercises, or to control flight (using flight trainers, with and without loud cockpit noise.)

Nevertheless, we should not dismiss annoyance as a figment of the imagination. Some physiologists assert that annoyance should be considered as a biological protective mechanism, inducing man to avoid noise and to seek recovery processes. The biological meaning of annoyance may be comparable to other feelings of discomfort like fatigue, hunger, cold or warm sensations.

The clip-clop of horses and the rumbling of carriages in an earlier day were quiet enough to be romantic. Traffic noise was no real problem so long as people were forced to content themselves with these slow means of transportation.

Today's urban noise is largely the result of people's insatiable desire to reach distant places ever more rapidly and comfortably. As we have developed faster ways to transport ourselves and our commercial goods, we have created a noise nuisance that is becoming increasingly difficult to live with.

Cars, buses, trains, trucks, and airplanes are a necessary part of our lives. It does not follow, however, that all the noise created by these machines must also be a part.

Which noises are the most troublesome to the inhabitants of a city? The 1,400 people interviewed in a British survey were asked, among other things in a questionnaire, "If you could change just one of the many things you don't like about living around here, which would you choose?" They responded as follows:

- Noise was mentioned as often as slums, dirt, smoke, public facilities, transport, government, and the amount of traffic.
- About one-third of the total sampling specifically mentioned motor-vehicle traffic noise as one of its major irritants.
- Four to seven times as many people were disturbed by the noise of road traffic as by the noise of aircraft, trains, or industry.
- Traffic noise appeared to be as important an annoyance as all other noises together, including the noises of aircraft, trains, industry, construction and demolition, domestic appliances, neighbours, children, radio and television, bells, alarms, and pets.
- People tolerate greater intensities of continuous noise than they do of intermittent noise. Also they tolerate higher (but less-frequent) levels of noise from aircraft than lower (but nearly continuous) levels of noise from automobiles.

Similar surveys of occupants of apartment buildings in Rotterdam and The Hague, Netherlands, revealed that 25 per cent were annoyed by traffic sounds; 12 per cent by children playing; and 10 per cent by doors slamming. There is, of course, a close relation between annoyance and the location of the building. The Netherlands survey also indicated that:

- Noise nuisance is greatest in homes where children must study in the evenings or where adults read extensively or engage in self-education.
- Noise nuisance decreases with increase in family size and increases as the children grow older.

Based on these fairly representative surveys, it is abundantly clear that a city's first efforts to produce quieter living must be directed at reducing noise from traffic.

THE steady flow of passenger-car traffic alone would not necessarily be irritating. Many new cars are equipped with good exhaust silencers and quiet tyre treads. Cities and highway builders have it in their power to choose quiet road surfaces. The real trouble lies with trucks, buses, motorcycles, and sports cars. The average truck at 60 miles per hour is about twice as noisy as a steady stream of automobile traffic. Further, truck noise is more irritating than this difference indicates because trucks pass less often and the loud burst of noise that results is distracting and annoying. The same holds for sports cars, motorcycles, and buses.

Many old cars are more noisy than new ones, usually due to deterioration of exhaust mufflers. Lack of shielding of engine noise and inadequate mufflers are common on trucks of all ages.

The British Government is considering a law that would require all new passenger cars and trucks to have noise levels lower than 85 dBA. (noise measured in decibels on the

Noise from the growing volume of air traffic disturbs schools near large airports. The International Congress for Noise Abatement reports that as much as 50 per cent of teaching time can be lost through teachers' voices being drowned by the roar of aircraft. Outdoor programmes have to be abandoned and teachers and children suffer from noise fatigue. Elaborate sound-proofing or the transfer of schools to quieter locations are often too expensive to be feasible.

Photo © Audrevs, Paris

"A" scale which partially discriminates against the lower tones in a noise, much as a person does when judging the "noisiness" of a sound). Motorcycles and other mechanically propelled two-wheeled vehicles would be limited to levels below 90 dBA.

The acoustical test for British automobiles requires measurement of the noise at a point 25 ft from the centreline of the lane in which the vehicle travels for three different operating conditions:

- constant speed of 30 mph in top gear;
- starting from a steady speed of 30 mph and (beginning 32 ft before passing the test microphone) accelerating as rapidly as possible over a distance of 65 ft; and
- maintaining a constant speed of 30 mph at full throttle with brakes applied. The highest noise level obtained under these three conditions of test is used to rate the vehicle.

The State of California has proposed legislation which would prohibit noise levels in excess of 82 dBA, for passenger cars, and 92 dBA, for heavy trucks and for trucks and buses at posted highway speeds or the maximum speed of the vehicle.

In France, maximum permissible noise levels, determined under the British test regime, are 83 dBA for passenger cars and small trucks, 86 dBA for motorcycles, and 90 dBA for large trucks and buses.

In Switzerland, maximum permissible noise levels, measured laterally in an open field at a distance of seven metres with full engine power, are 80 dBA for passenger cars, 85 dBA for two-stroke motorcycles and 90 dBA for 4-stroke motorcycles, large trucks, and buses.

Hit-or-miss municipal and state laws designed to control the noise of surface transportation generally are not effective. Trucking today is largely between countries or states. The increased costs of providing and maintaining adequate mufflers and engine covers are such that compliance with noise laws will be assured only if they are international (in Europe) or national (in large countries such as Brazil, U.S.S.R., or U.S.A.) and apply to all vehicles.

Traffic noise, serious as it may be, disturbs only a relatively narrow strip of property on either side of the right-of-way. To those who complain of the nuisance, there is a reasonable reply. Move! But not so with modern planes.

During takeoffs and landings, large transcontinental and international jet airplanes may disturb and annoy thousands of people spread over many

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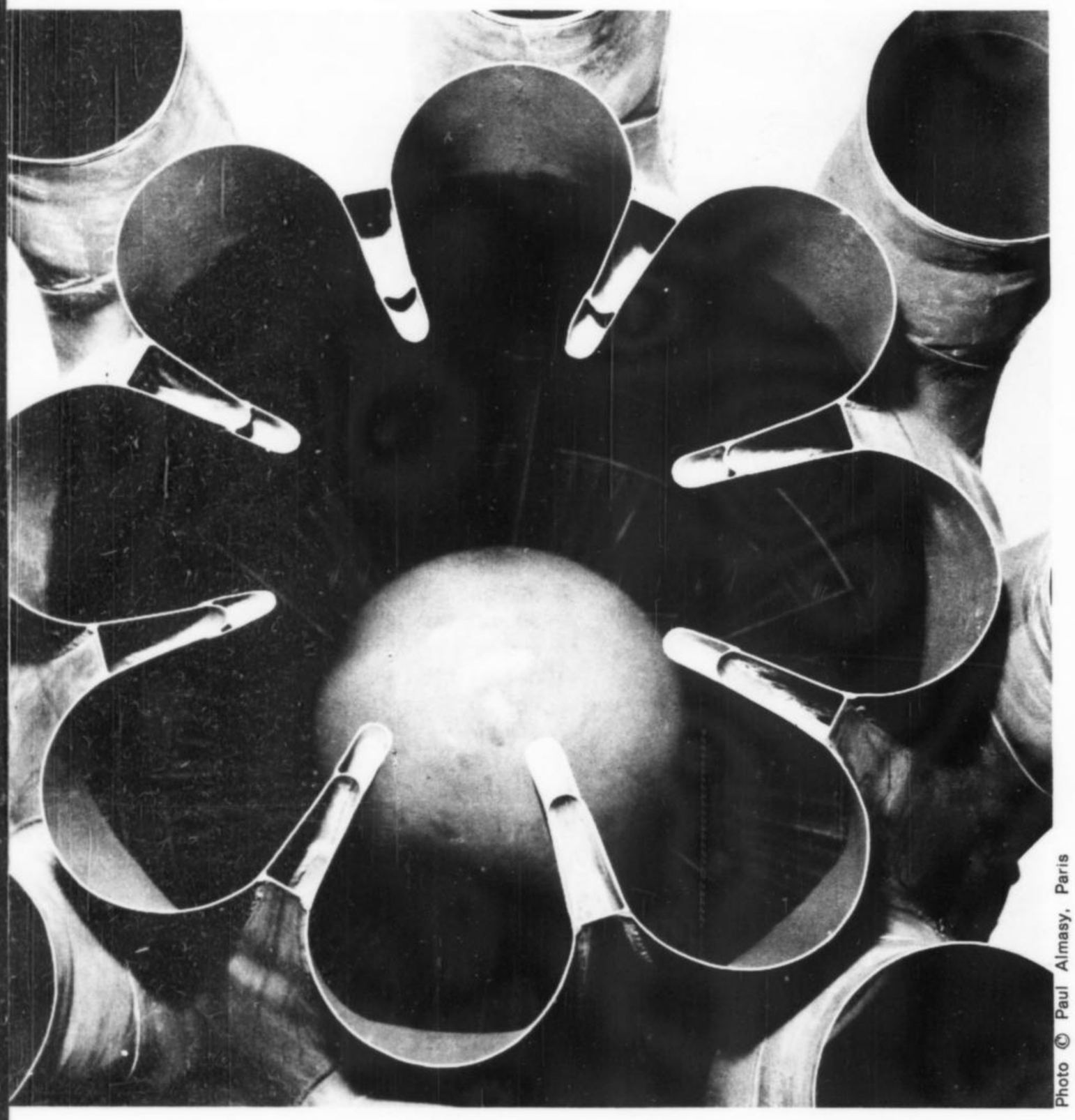

Photo © Paul Almasy, Paris

Aircraft have become the biggest noise in a noisy era. Having created engines of tremendous power, technicians have had to develop silencing devices, like the muffler tubes on the jet engine above, that tone down the noise without an excessive loss of power. Below, a glant "exhaust pipe" leading from a Paris airport building used for testing engines. It muffles the noise and directs what is left skywards.

Photo Air France

Engine nacelles

acres. The increasing popularity of helicopters promises to pose new problems. Heliports, uniformly distributed throughout a city, would affect all residents.

With the advent of supersonic aircraft, nobody in a nation can be sure of freedom from sonic booms. A nation could, of course, refuse supersonic aircraft entrance into its air space, and restrict the operations of high-powered and, hence, noisy aircraft to isolated areas. But this is hardly a practical solution for nations ever more dependent on large aircraft for commerce, travel, and defence. We must search for other answers.

How much aircraft noise is too much? Attempts have been made on a number of occasions, in the Federal Republic of Germany, the Netherlands England and the United States, to determine a relation between PNdB (adjusted for the number of flights per day) and the "annoyance" of aircraft noise as judged by residents under flight paths near airports. (PNdB is the perceived-noise-level in decibels, which takes into account the individual judgment of the loudness of different types of noises.)

It appears that there is a significant degree of dissatisfaction with aircraft noise whenever the average value of the maximums of the flyover noise exceeds about 115 PNdB (assuming 20 to 40 flyovers each day during daytime hours).

The British Ministry of Aviation has specified maximum permissible noise levels in the main built-up areas around the London airport for jet aircraft on takeoff, as follows: for hours between 7 a.m. and 11 pm, 110 PNdB; after 11 p.m., 102 PNdB.

At the Kennedy Airport in New York, the Port of New York Authority has specified a maximum permissible figure for jet takeoffs over neighbourhoods of 112 PNdB. At night, jet takeoffs are generally permitted only from runways that lead over water. The airports of Paris are also discussing similar restrictions. No restrictions are made on landing noise at London's or New York's airports.

Factors other than noisiness (in PNdB) enter into the annoyance created by aircraft operations. Among the more important are the average duration of the noise of single flyovers, the number of flyovers per day, and the time of day in which they occur. It appears from judgment tests that doubling the duration of noise associated with each flyover or doubling

above the wings to reduce the roar

the number of flyovers each day is equivalent to a three to four PNdB increase in the level of a single flyover.

People are more sensitive to aircraft noise during the late evening or night, partly because the ambient noise is lower and partly because people are trying to sleep. Some studies have indicated that noise levels between 10 p.m. and 1 a.m. must be 10 or more PNdB lower than those between 7 a.m. and 10 p.m. if people are to judge the noise situation as being about equal.

If the land around an airport were strictly zoned to prevent residential construction, the aircraft-noise problem would be much less significant. But around existing airports, zoning against housing generally cannot be used as a substitute for the needed exercise of the power of condemnation and the ensuing obligation to pay for whatever is expropriated.

Unfortunately, private airport owners possess grossly inadequate resources to pay the price of expropriation and, in the past, municipalities generally encountered public objection to prohibition of residential construction, even near airports.

THE citizens of some countries are demanding that their parliaments should pass legislation requiring all aircraft to produce lower noise levels in neighbourhoods. However, a law that would specify lower maximum acceptable levels to be met by all operating aircraft will do little immediate good, since most of today's aircraft cannot meet a substantially lower noise requirement.

Noise limitations must first be imposed on new aircraft entering the airlines' inventories. Then attrition and the retro-fitting of silencers to existing aircraft, where feasible, become practical avenues toward quieter flight.

U.S. Federal requirements on acceptable noise levels before certification of new aircraft are the existing legal means available to accomplish this result. Without such regulation, competitive pressures in both the manufacturing and operating industries will maintain the same lack of concern about noise as that which now exists for noise from trucks.

Primarily as the result of regulations by the airports of England, France, Australia, Denmark and U.S.A. and, in turn, airline purchase specifications, manufacturers have fitted silencing devices to the exhaust ports of most turbojet engines. These silencers reduce take-off noise to some extent.

The newer bypass (turbofan) engines provide considerably higher thrusts without a proportional increase in noise. Unfortunately, silencers on their exhausts do little additional good. For new aircraft, manufacturers are studying ways to mount the engine nacelles above the wings so as to shield neighbourhoods from much of the engine noise.

Aircraft are also noisy on approach to landing both because of the whine of the engine-intake compressors and because most pilots believe it is safer to land at a low glide angle while using appreciable engine powers. To achieve a large angle of the glide path at which an airplane approaches the runway—6° to 8° instead of 3°—the airline pilots say that better instrumentation (perhaps computer control of landings), better engine response, and better airplane-handling qualities would all have to be provided in the aircraft.

At least one country is experimenting with regulations that require jet aircraft to climb as rapidly as possible to an altitude of about 1,500 ft and then to cut back engine power in order to reduce noise until the aircraft reaches an altitude of 3,000 ft. To avoid flying directly over houses at low altitudes, the aircraft must also turn after takeoff and until it has gained considerable altitude follow a river or a highway.

The means seem available for appreciable control of in-flight aircraft noise. Included are: refinement of aircraft design so they can climb and land at steeper angles, embodiment of better noise-control features in engines, nacelles and wings, and introduction of sophisticated operating procedures.

But until regulations spell out maximum-permissible noise levels appropriate to differently zoned urban areas and certificate new aircraft only if they can meet these requirements, it is not likely that the upward trend of aircraft noise levels will be arrested.

Many people are apprehensive of the noisiness of the next generation of aircraft, known as the supersonic transport, or for short, the SST. Any airplane traveling faster than the speed of sound produces pressure, or shock, waves around the nose and around each protruding part of the airplane. These waves are analogous to those on either side of the bow of a rapidly moving ship.

Shock waves form a cone that encircles and fellows the aircraft and intersects with the earth. As the line of intersection with the earth advances with the movement of the airplane, people living within the width of the intersecting path usually hear two closely-spaced explosive sounds, known as the "sonic boom". Typically when first experiencing the sonic boom residents are startled and frightened.

Their reactions are caused in part because the boom occurs without any prior warning and in part because the individual is conditioned to associate loud explosive-like sounds with possible damage to his home, or to his person. He may imagine that something has exploded nearby or a vehicle has struck his dwelling. Or, he may fear that repeated booms will crack plaster, loosen fixtures, and weaken the structure of his house.

MEASURED outdoors, a typical sonic boom from a high-flying aircraft is a pressure wave that suddenly increases above normal atmospheric pressure by 0.5 to 2 pounds per square foot, then decreases somewhat more slowly to below normal atmospheric pressure by about the same amount, and finally jumps back to atmospheric pressure. The result is an N-shaped pressure wave less than half a second long. The lateral spread of the boom becomes greater as the altitude of the airplane increases, although the intensity of the boom decreases.

The American Government has vigorously pursued investigations of the effects of sonic booms on people and structures. One of these investigations was carried out over the Oklahoma City area from February to July 1964. During this period, the population was subjected, during daytimes only, to a total of 1,250 sonic booms. The average intensities of the booms were 1.13 pounds per square foot (psf) during the first 11 weeks, 1.23 psf during the next eight weeks, and 1.60 psf during the final seven weeks of the programme.

From complaints received and interviews of the residents, it was found that the sonic boom was, in some measure, a disturbing influence in the lives of most of those people living within eight miles to either side of a line directly below the flight path.

At the end of six months, about one-fourth of the people interviewed said that they felt that they could not learn to accept eight booms a day, at least

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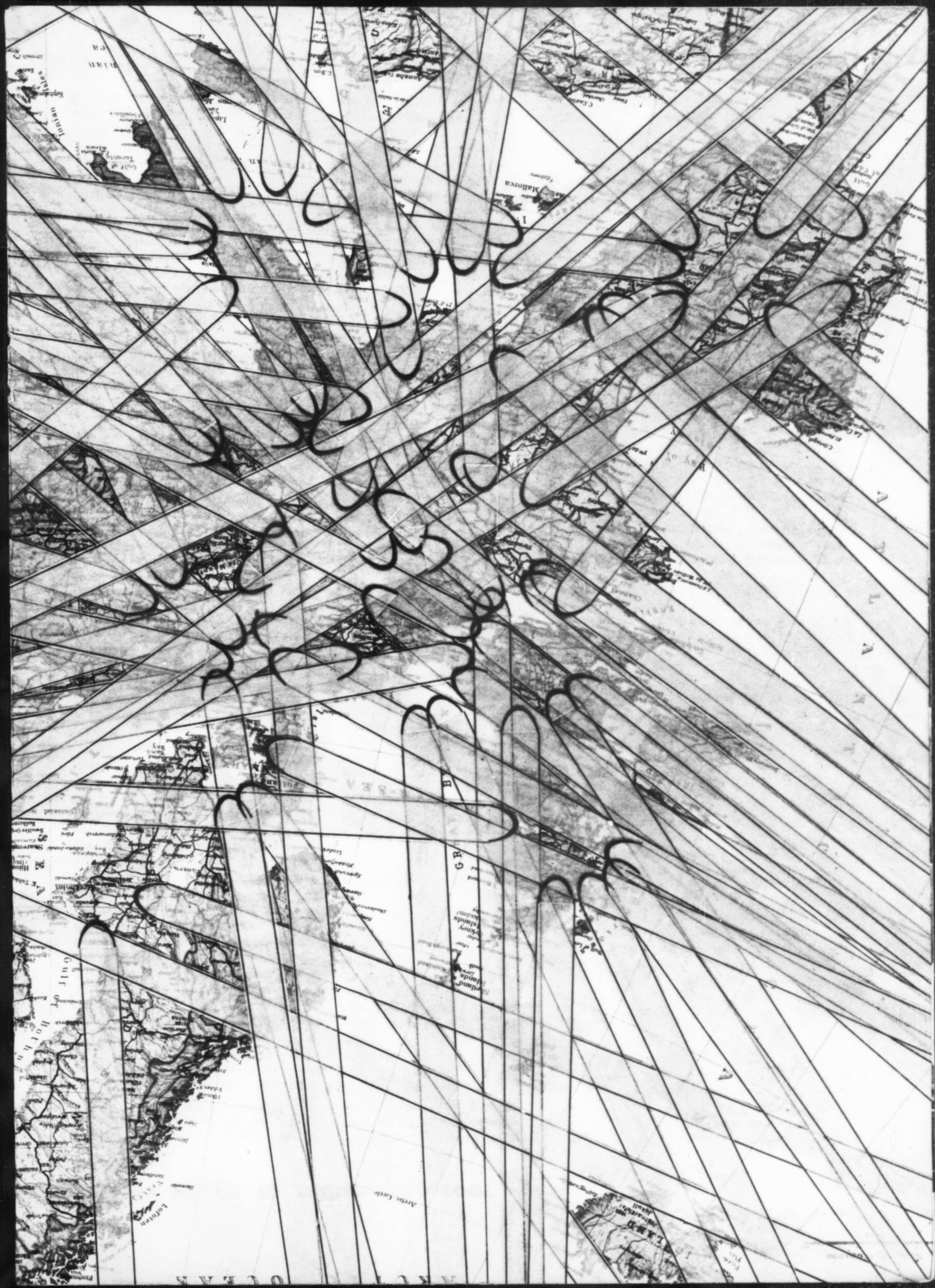

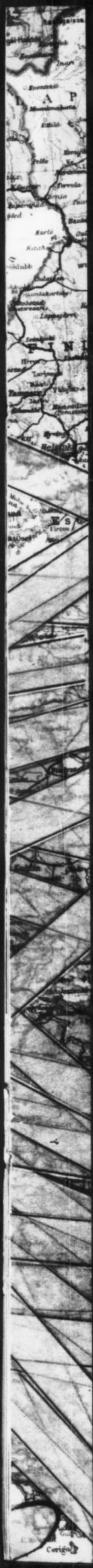

A sonic boom from an aircraft "breaking the sound barrier" may startle us, but it is still a relatively rare disturbance. However, the prospect of regular supersonic flights sometime in the 1970s is already creating concern. Some aeronautical specialists, including Bo Lundberg, Director-General of Sweden's Aeronautical Research Institute, maintain that the shock waves set up by planes flying at from 1,500 to 1,800 m.p.h. will hit the ground in every spot within a "boom carpet" 50 to 80 miles wide along the entire flight path. Plotted on map (left) are "boom carpets" that might be "unrolled" over Western Europe unless restrictions were imposed. Sonic boom disturbances, say other specialists, can be kept to a minimum providing sonic speeds are maintained until aircraft are clear of certain areas. Drawing (right) shows how a conical shock wave created by supersonic flight follows plane and intersects with the ground.

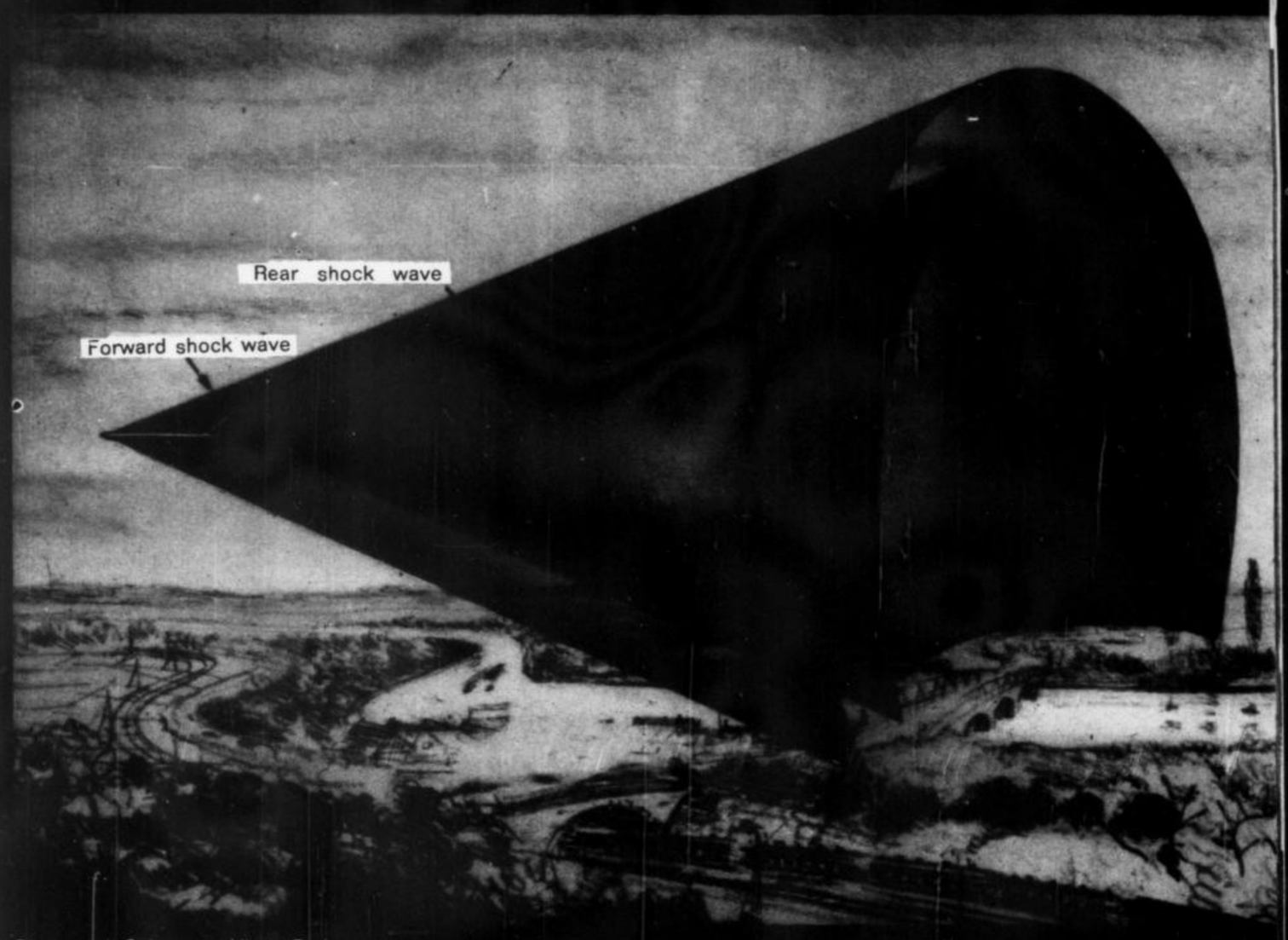

Photo © "Science et Vie", Paris

SUPERSONIC 'BOOM CARPET'

"Stop the noise", "We want to sleep undisturbed", "Silence for our schools" proclaim the banners carried by these demonstrators protesting, on November 19, 1966, against the noise caused by aircraft using Orly Airport near Paris. The demonstrators, representing some 500,000 people living in the area, are headed by several mayors wearing their sashes of office.

Photo © Camille Klein, Villeneuve-le-Roi

Photo The Aeronautical Research Institute of Sweden

TRAFFIC NOISE *(Continued from page 17)*

8 booms a day won't keep the doctor away

at the 1.6 psf level. At some lower pressure level, as yet to be more definitely determined, very few people should be annoyed.

The most significant result from the Oklahoma tests was that many residents believed their homes were being damaged by the sonic booms, although continuous observation of a number of houses showed no damage. In other parts of the country, near military bases where supersonic military aircraft are regularly flown, large areas of houses have been subjected to sonic booms, many greater than 2.0 psf. The number of damage claims filed by persons in those areas has been small.

Nevertheless, over 40 % of those interviewed in Oklahoma City felt that their homes had been damaged. This result suggests that belief in alleged damage to property increases annoyance and complaints. It also suggests that people might be less concerned with sonic booms if it were clearly demonstrated that SST noise levels at or below those specified by the government would not damage structures.

There is no question about the future of supersonic transport aircraft —the French-British SST will enter service soon. Sonic booms are unavoidable, but it seems that overpressures should be held within limits that will not disturb people greatly or harm property. It seems mandatory that acceptable boom levels be established internationally and that SST operations afterwards be policed to assure compliance with the regulations.

People in modern societies *must adapt* in some measure to the noises of modern civilization. The extent to which adaptation is necessary is largely a matter of economics and convenience. At moderate cost and some loss of convenience, the hearing of workers can be protected. Noise created inside office buildings and dwellings can be reduced to acceptable levels by proper use of materials and structures for noise control. The noise of transportation can be made less annoying by suitable designs of vehicles, by requiring noise limits for new vehicles, by legislation and enforcement of noise codes, by operating vehicles properly, by zoning and condemnation of residential areas near airports and superhighways. In the worst cases, we may have to resort to sealed, fully climatized housing.

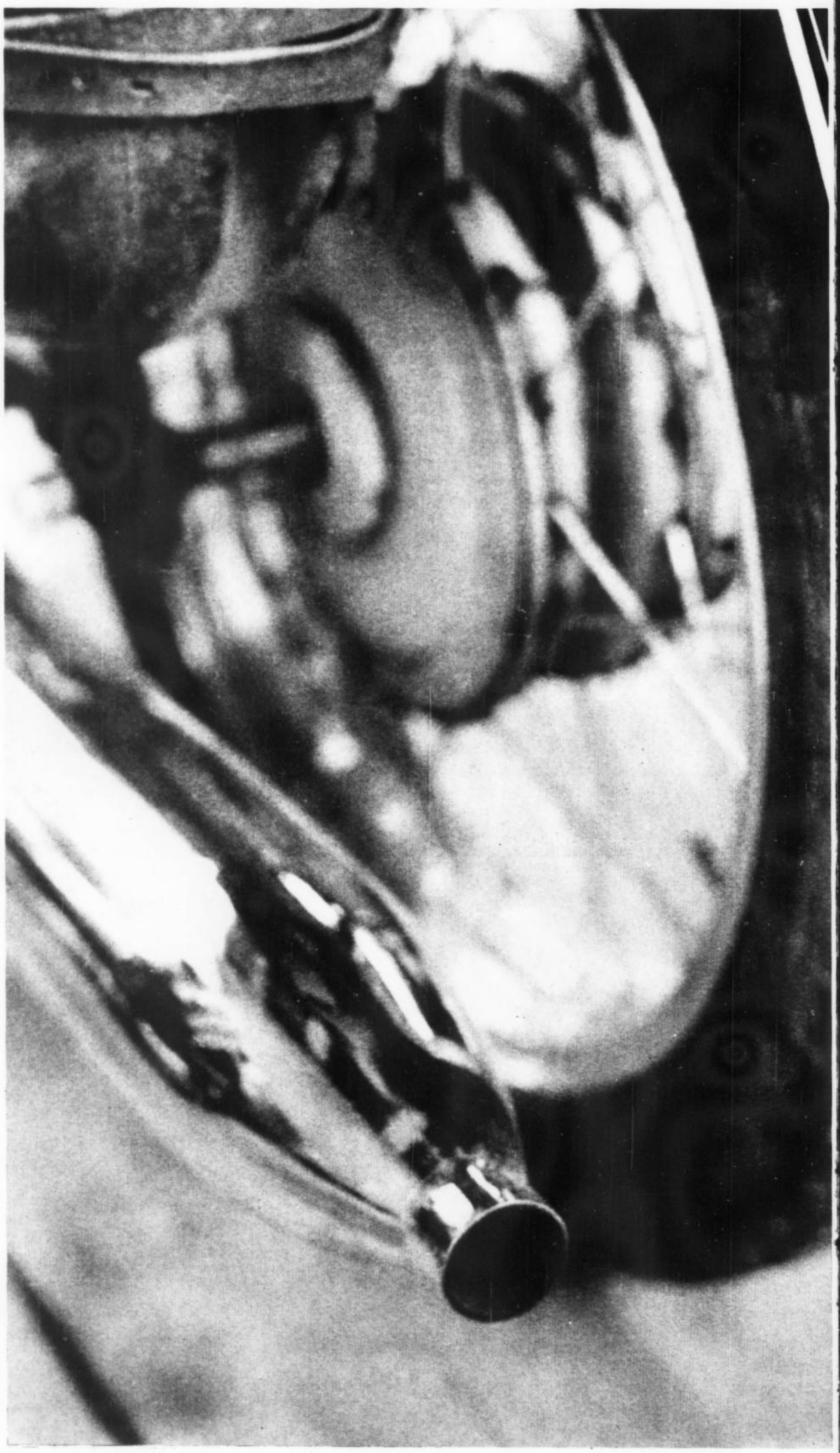

Photo © Albert Winkler, Bern

Motorcycle engines are powerful, compact—and noisy, even though, their exhaust pipes are fitted with silencers (left of photo). Though these have little effect on the power output of the engine, some motorcyclists modify them and thereby reduce their efficiency as noise mufflers.

CORDOBA (ARGENTINA) TAKES NOISE ABATEMENT BY THE HORNS

by G. L. Fuchs

THE city of Cordoba in Argentina, where I live, has over 600,000 inhabitants—and some 50,000 motorcycles and motorscooters.

Cordoba's municipal regulations on noise were introduced many years ago and had long been ineffective. Yet nothing was being done to bring them up to date. This fact, coupled with an explosive growth and the wave of industrialization which began in the 1940s, had given Cordoba one of the highest noise levels of any city in Argentina. This applied not only to downtown Cordoba, with its constant roar of traffic, but also to residential areas among which industrial plants and shops of all kinds had been installed.

In 1960 we started our first noise abatement campaign, sponsored jointly by the municipal authorities, the University of Cordoba and a number of private organizations. A noise symposium was held and it was decided to ask the International Association Against Noise to assist Argentina in setting up a National League Against Noise.

An official "Silence Week" followed the symposium and did much to arouse public interest in the need for noise control. It also brought some relief through the temporary suppression of automobile horns and loudspeaker advertising. But the improvement was short lived because of the lack of inspectors and the inadequacy of Cordoba's noise regulations.

In 1964 we set up Argentina's first Noise Abatement Council (*Consejo Permanente de Lucho contra el Ruido)* following which Argentina was admitted to the International Association Against Noise the same year.

I would like now to outline our case history that might assist other towns and countries in a similar situation.

Firstly, our new anti-noise municipal regulation distinguishes between "unnecessary" and "excessive" noise. It classifies over 15 unnecessary noises which can be penalized without recourse to noise level measurement or analysis.

Since the application of the anti-noise law we have classified as unnecessary noises all public address systems that can be heard outside enclosed premises, including music, publicity and speeches.

The second category (excessive noise) covers those that even when justified may exceed limits that affect the well being and tranquility of our citizens. For the first time in our legislation, we have established noise levels based on European criteria: average levels for day-time (6 a.m. to 10 p.m.) and night-time (10 p.m. to 6 a.m.), as well as infrequent peak levels (up to six hours) and frequent peaks (more than six hours) which are allowed in each case.

Since we have not been able to make a noise survey of the city nor to delineate appropriate zones, we have

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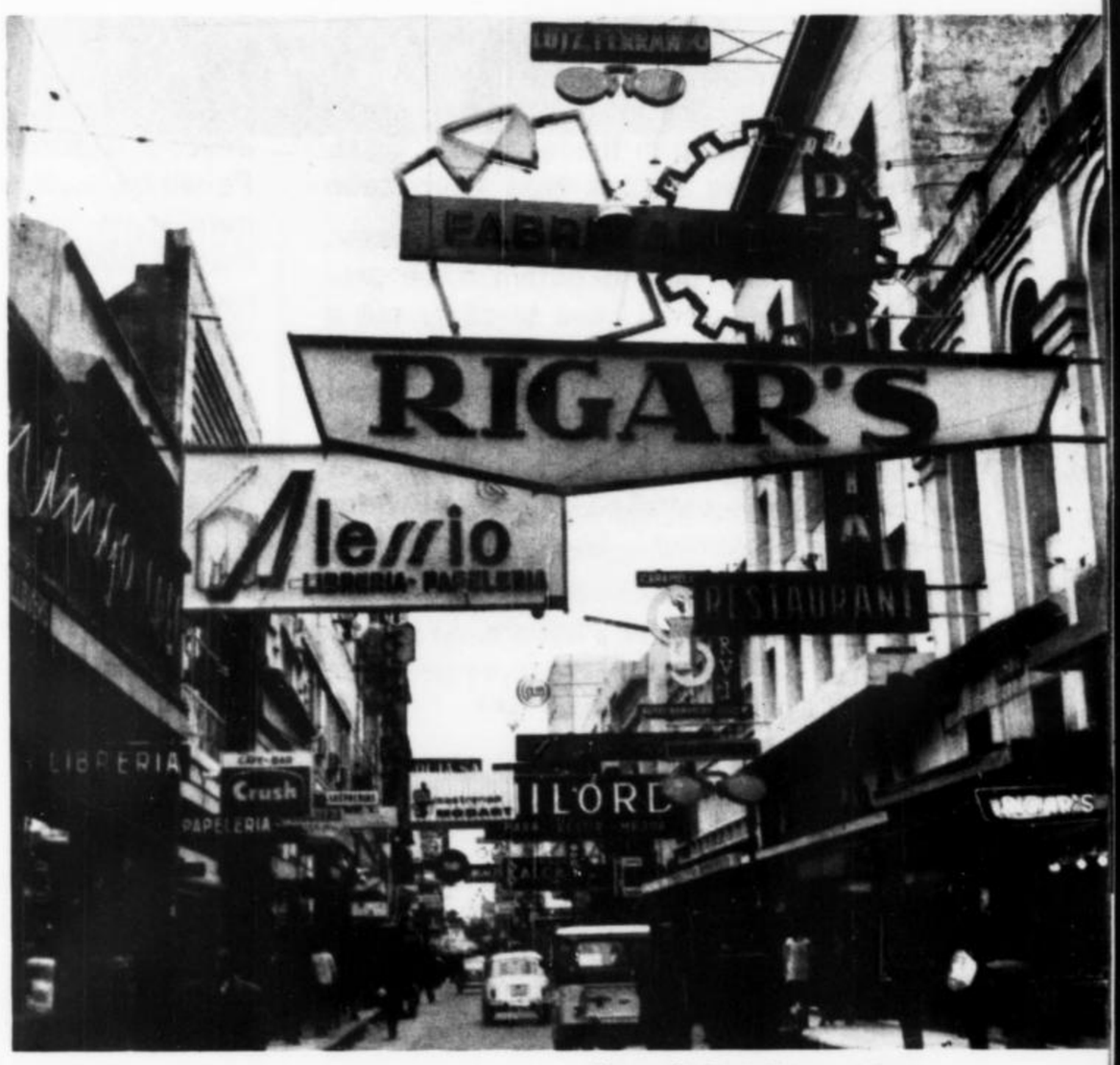


As a rapidly developing centre of commerce and industry, Cordoba won the unenviable reputation of being one of the noisiest cities in Argentina. In the past seven years, however, the city authorities and the University of Cordoba have been campaigning against the noise nuisance, launching educational programmes and tightening up local anti-noise regulations. Right, a street in the centre of Cordoba.

Photo © Paul Almasy, Paris

G. L. FUCHS, *an Argentine engineer, is professor of acoustics and director of the acoustics research centre at the University of Cordoba (Argentina). This article is taken from the paper presented by Professor Fuchs to the Congress of the International Association Against Noise, in 1966, at Baden-Baden (Federal Republic of Germany).*

One motorcycle for every 12 persons

had to classify environments in the following categories: hospitals and similar institutions; residential sections, schools and small shops; downtown business areas and multi-storied buildings; industrial areas and main roads or freeways.

It has been something of a problem to classify the appropriate environment in each case. But some difficulties notwithstanding, the system works well and has led to few controversies.

"Critical" areas for hospitals and convalescent homes have been established and circles of 200 metres diameter drawn around these institutions. The law has been modified to exclude all noisy industries such as metal works and factories from these areas. Existing industries of this type have been invited to find new locations.

We realize that to obtain more precise data we shall have to carry out a noise survey of Cordoba City. But so far we have found that our noise level readings correspond closely to subjective complaints on noise, and that the public is satisfied in places where the established levels are not exceeded.

Vehicle noise limits have been based on the results of experiments in other countries, chiefly Switzerland.

A team of five men trained in our laboratory checks noisy vehicles on main thoroughfares. These inspectors are not yet equipped to measure noise levels but their estimates of abusive noises have been highly accurate (an error of one per cent or less was noted in the first year, when 3,000 noise offenders were fined). When offenders contest noise estimates, they must report immediately to the noise laboratory for an official test.

MOTORCYCLES are our greatest problem. There is one motorcycle or motorscooter for every 12 persons in our city and these vehicles are usually driven at high speeds. Some motorcycles have silencers of poor quality, and our laboratory is studying how to improve the efficiency of silencers on models manufactured in Argentina. In our view, the ideal system of control would be an obligatory test of motorcycle silencers once a year when driving licences are renewed.

Horns and silencers fitted on cars and motorcycles do not come under municipal jurisdiction and so we need a national law to exercise a control on their manufacture. The same applies to noise checks on Argentina's interprovincial highways. And for a more effective restraint of noise offenders, co-ordination between municipal authorities is needed within each province.

An important feature of Cordoba's Noise Abatement Council is that its function is not only to advise on noise reduction, but also to decide on the application of penalties for noise offences.

LIABILITY for an infringement of noise regulations covers not only those directly responsible, but anyone associated with the offence. Penalties include fines, temporary or permanent cancellation of driving licences and the closing (temporarily or permanently) of shops, clubs and other businesses.

In Cordoba, we have studied some of the psychological aspects of noise offences. Why, for example, do drivers, and especially motorcyclists, remove or modify the mufflers on their vehicles? Is it because a personality defect makes them enjoy excessive noise? Or does the noisy urban environment give them a kind of "thirst for noise?"

In our survey of this problem we have questioned offenders, but it is still too early to venture an explanation on the basis of solid statistical data. In the case of motorcyclists—the most common one in our experience—we have reason to believe that one motivation for having a noisy machine is the fear of being run into by automobiles. It has been noticed for instance that drivers of well-muffled motorcycles and scooters tend to "toot" excessively, whereas riders of noisy machines seldom use their horns.

Another of our findings is that well educated people (scientists, scholars, artists and members of the liberal professions) are far more susceptible to the noise of traffic than relatively uneducated people.

Noise is a social problem and its solution calls for intensive campaigns to alert the public to the need for action. Rapid industrial development has made it an especially urgent problem in Argentina. That is why we are endeavouring to set up a League Against Noise to deal with the question on a national scale and with greater resources.

Taking the din out of dinosaur

Drawing by Kenneth Mahood, from "A Noise Annoys" © Pergamon Press Ltd., Oxford.

ECHOES FROM OUR NOISY WORLD

New techniques to reduce the noise of building construction have recently been introduced. But little has been done to muffle the demolition operations that often precede work on a new building. Here, rubble from old buildings thunders to the ground under the impact of sledge-hammers and bulldozers. People in nearby apartments try to live with the din, and hope that the building operations will be less disturbing.

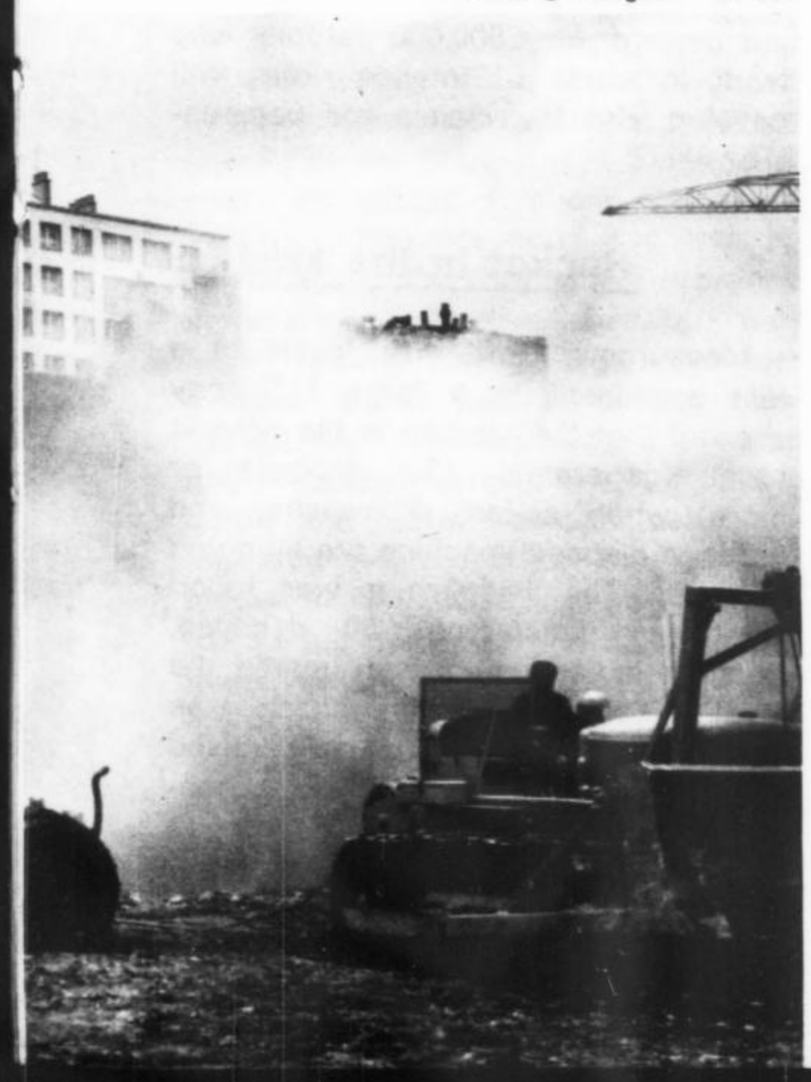
Dogs, cats and flying bats...

Many animals have far more perceptive hearing than man. Dogs have a remarkable "auditory memory" and can recognize a change of even an eighth of a tone in a signal taught them weeks earlier. Canine noise receptivity extends two octaves above that of a human being (a cat's only one octave). As they fly, bats give a continuous cry so high pitched as to be inaudible to man. When these supersonic waves strike obstacles in the path of the bat they echo back to its sensitive ears and enable it to take avoiding action. With this remarkable "radar" apparatus bats can fly in pitch darkness without danger of collisions. Experiments reveal that salt water fish hear only deep-toned sounds whereas fresh water fish hear high-pitched ones.

A noise 'cure' good for everyone

The growth of motor transport in the past 20 years has led many countries to revise their traffic codes—sometimes in the face of public opinion. The decision to forbid the use of motor horns in Paris was one such controversial move, and motorists in particular predicted that street accidents would increase. In practice the measure was remarkably successful. With a show of self-restraint that surprised the Parisians themselves the honking and blaring of horns was stilled from one day to the next. Paris now wonders how it ever managed to endure such a futile and nerve-racking din.

Photo © Fotogram - Corson



8 DECIBELS TOO MANY. Tokyo, with its 11 million inhabitants, wages an incessant campaign against unnecessary and excessive noise. At the entrance to the Nishi-Ginza underground station, for instance, a big hoarding indicates the local noise level. It shows the number of decibels allowed—50 in residential areas; 70 elsewhere—and above in large luminious figures the actual number of decibels being recorded, here 78.

Photo © AGIP, Paris

Noisy motorcycles most popular

International agreement on noise levels for new vehicles and a programme for reducing such levels would be a step forward in the campaign against traffic noise, says a report by the Council of Europe. The car industry would have an incentive to seek greater improvements in the reduction of vehicle noise. So far, notes the report, the industry has devoted much attention to acoustic performance such as mechanical and body noise, whereas silencers for successive models with increased engine performance are designed so as to avoid a large power loss. "Though efforts are directed to perfecting more efficient silencers." says the report, "motorcycle manufacturers find that the greater demand is not for the more silent types."

Noise a killer

Laboratory experiments have demonstrated that sound with an intensity of 150 to 160 decibels is fatal to certain animals. The animals suffered from burns, spasms and paralysis before dying. Recent ecological studies have shown that rats exposed to loud noise exhibit a marked decline in the pregnancy rate.

Sound outpaced

Passengers on tomorrow's supersonic flights will not be bothered in flight by the noise of the aircraft's jets. At supersonic speeds an aircraft outpaces most of the sound made by its engines.

Repressing a portable nuisance

Many countries have passed laws imposing limits on noise from advertising and entertainment. In particular the use of loudspeakers and transistor radios is restricted. France forbids the playing of transistor radios on rail,

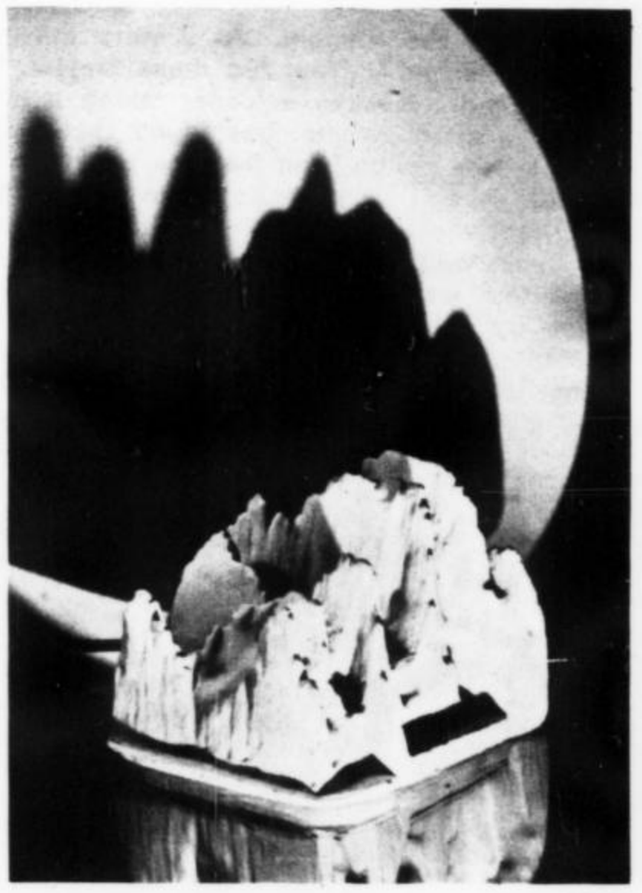


Photo USIS

A PIECE OF NOISE. This iceberg-shaped model is what sound would look like if it were solid instead of vibrations in the air. It was constructed by a New Jersey (U.S.A.) laboratory during research into the nature of sound and human ability to perceive and translate sound into knowledge stored in the brain. The goal of this research is improvement of communications by telephone, radio and television.

CONTINUED ON NEXT PAGE

ECHOES FROM OUR NOISY WORLD

(Continued)

bus and metro transport as well as in streets and public places such as parks and beaches. Nor is their use tolerated in restaurants and similar establishments.

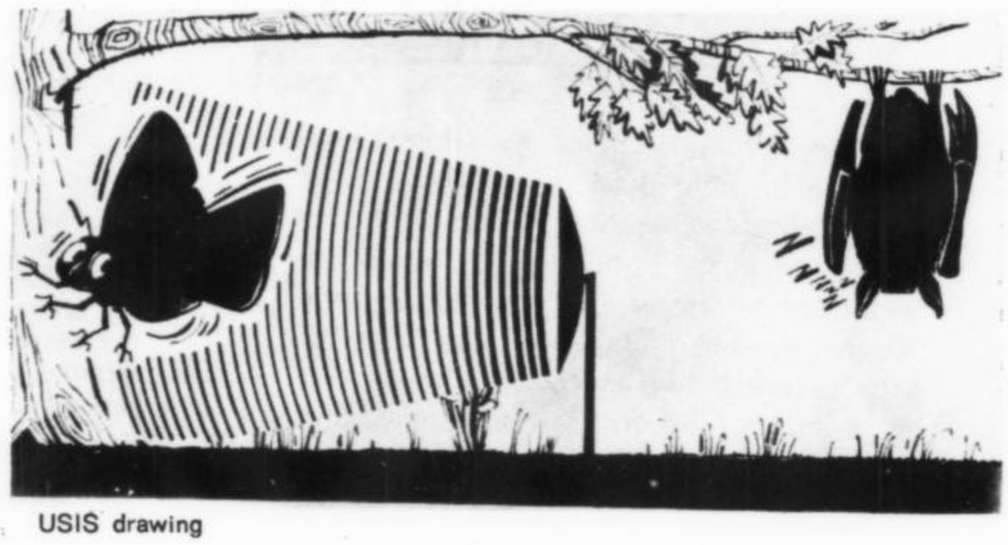
'White noise' or 'acoustical perfume'

The humming of air conditioners and the throbbing roar of "heat pumps", whose large fans fill houses and apartment buildings with heated air in winter and cooled air in summer have created two new forms of 'noise pollution'. Ironically, however unwanted the sounds these machines make, the hiss of air inside a conditioned building is a useful sound. Sound engineers call it "white noise" or "acoustical perfume" and they use it widely, especially in offices, to blanket distracting sounds that spring out of silence into disturbing acoustical relief.

Don't slam the door!

New York City has a law requiring walls soundproof enough to reduce any airborne noise passing through by 45 decibels. In Geneva, Switzerland, it is an offence to slam a car door too loudly. France confiscates automobiles that repeat noise violations. Rubber, plastic or leather guarded garbage cans are now used in many cities. Bermuda has instituted the quiet motor-bike. Outboard motors are losing their bark; truck mufflers that kill the roar are now available.

ULTRASONIC 'SCARECROWS'. Ultrasound broadcast by bats as they seek insects for food puts moths to flight. So to protect cotton and other crops from attacks by nocturnal insects, scientists use amplifiers to project batlike sounds over the fields.



USIS drawing

How to build quietly

A New York skyscraper completed last year proved that buildings can be constructed quietly. People working in offices near the new 52-story office building reported that power lawn mowers buzzing around their surburban homes were more disturbing than the construction job. Blasting was muffled by special steel mesh blankets weighing several tons each. Spread over the blast site by cranes, they absorbed most of the sounds of the explosions, and also kept flying debris safely within a confined area. All the joints on the 14,000 tons of steel in the frame were welded silently to eliminate the hideous, shattering racket of conventional riveting or bolting.

Deafness— an occupational hazard

Industrial deafness caused by noise exposure is not a new occupational disease. It first appeared with the advent of steam power and the steam boiler. It affected workers who made riveted boilers in such numbers that it was termed "boilermakers' disease". The hazard of damaged hearing due to noise is now recognized as a disabling possibility in almost all industries and trades. In U.S.A. it is estimated that approximately 1,000,000 workers have serious hearing loss due to high noise levels in their places of work. The potential cost to U.S. industry through compensation for hearing loss due to this cause is estimated at $500 million, based on the assumption that only ten per cent of the 4,500,000 persons who work in areas of intense noise will develop and file claims for compensation.

Racket in the kitchen

Measurement of noise levels in a test apartment in a large U.S. city showed that the kitchen is the noisest room (generating 100 decibels or more) when a fan, dishwasher and garbage disposal machine are all going at once. The living room was found to be a satisfactory 50 decibels. Running a vacuum cleaner raised the level to 73 db when the nozzle was on the rug. With the nozzle raised the level rose to 81 db (60 db is considered tolerable for a sports arena).

Peoples of the Ancient World were intrigued by the intelligence of dolphins and surrounded these playful, friendly creatures with myth and legend. Modern science, taking a closer look at these small relatives of the whale, has found that they emit ultrasonic noises and use the echos from them as a kind of radar guidance device. Photos taken during tests show (right) a dolphin "blindfolded" and (left) the same dolphin skilfully navigating between poles in the test tank, with the help of echos reflected back from these obstacles. In certain waters where dolphins abound, large numbers are killed by fishermen who blame them for damage to nets. The use of underwater sound transmitters to scare dolphins away from fishing grounds is being considered.

Photos USIS

Silent power

The British Hospital Authorities use more than 650 battery-powered electric vehicles within hospital grounds. Their first requirement is for a quiet running vehicle which will not create a noise problem for patients. Comparative tests taken at normal town speed between commercial electric vehicles and similar capacity petrol and diesel trucks showed the following results: Diesel: 81 decibels; petrol: 80 decibels; electric: 60 decibels (a figure lower than for most private cars).

A little energy can make a lot of noise

The noise of a crowd in a sports stadium would scarcely boil a saucepan of water, reports a conference on "The Control of Noise" organized by Britain's National Physical Laboratory. Other facts from the report: The noise of a 200,000 h.p. jet engine would produce about 20 h.p. One 10,000th part of the energy of this jet engine escapes as noise. To reduce the noise to a comfortable level, the engine would have to be modified so that only one part in a million of its energy escapes as noise. To reduce it to inaudibility, escaping energy would have to be reduced to one part in ten million.

A far 'buzzier' place

Even without supersonic aircraft, the sky of the future will be a far busier and noiser place than it is today. In the U.S.A. alone, the 90,000 privately owned planes of today will have increased to 150,000 by 1975, and the 112 U.S. airports now equipped for jets will number 300 within four years.

Electronic 'ears' aid the deaf

Deaf people have benefitted immensely from this century's progress in science and technology. Since 1876, when Alexander Graham Bell's invention of the telephone was inspired by his work with devices for the deaf, increasingly effective hearing aids have helped to consign the ear trumpet to the rubbish heap. Electronics and miniaturization (thanks to the transistor) have given deaf people better and more inconspicuous hearing aids (worn behind the ears or hidden in spectacles). Improved medical equipment has brought better understanding and diagnosis of hearing defects and in many cases modern surgical skills can restore certain kinds of faulty hearing to an almost normal level.

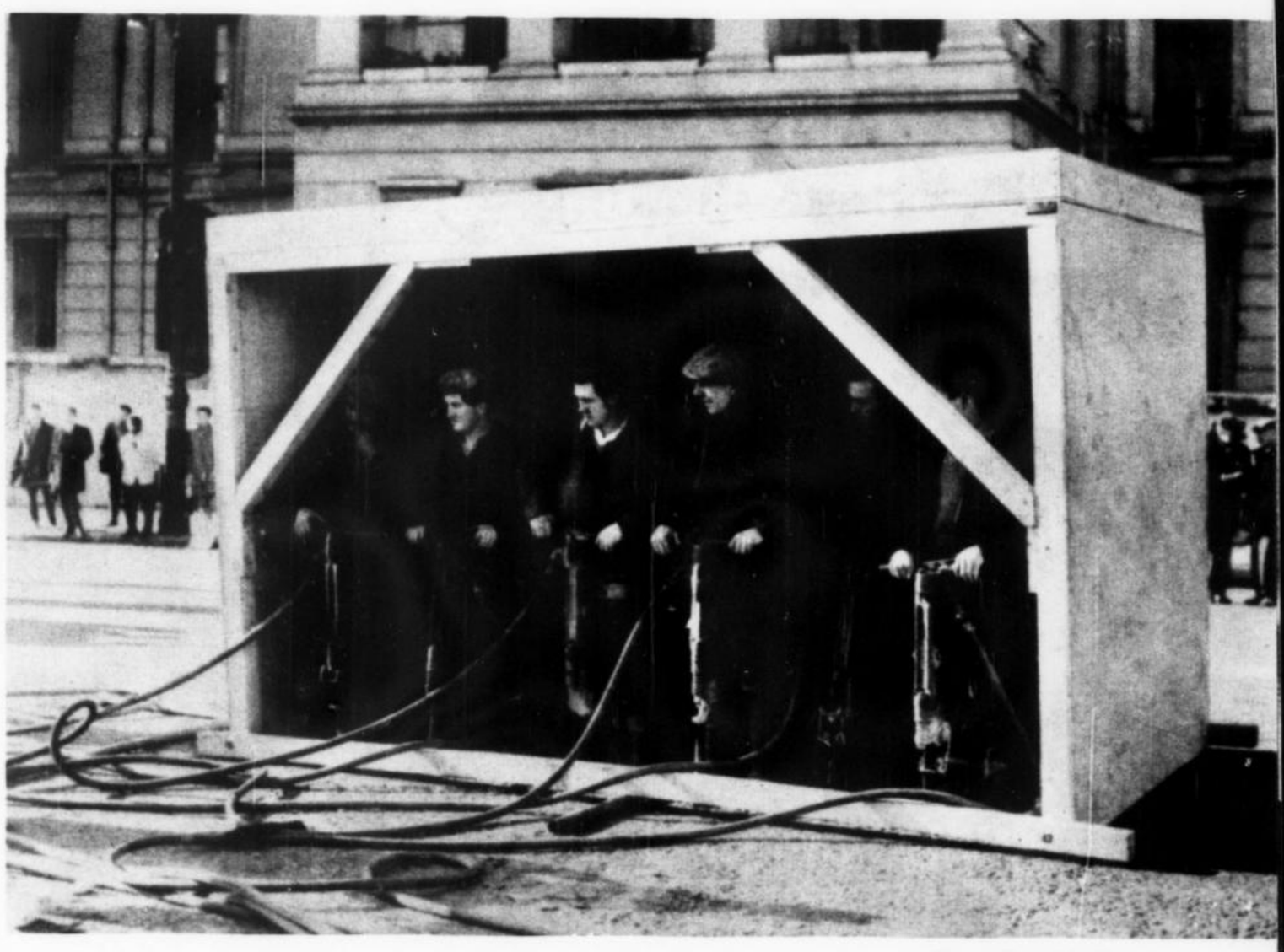
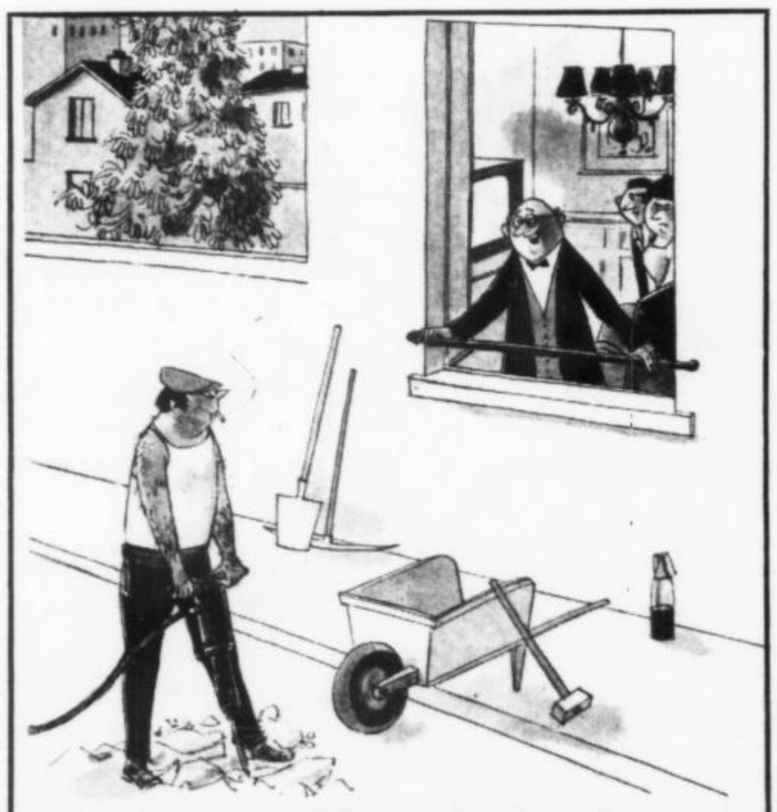


Photo © A.D.N.P.

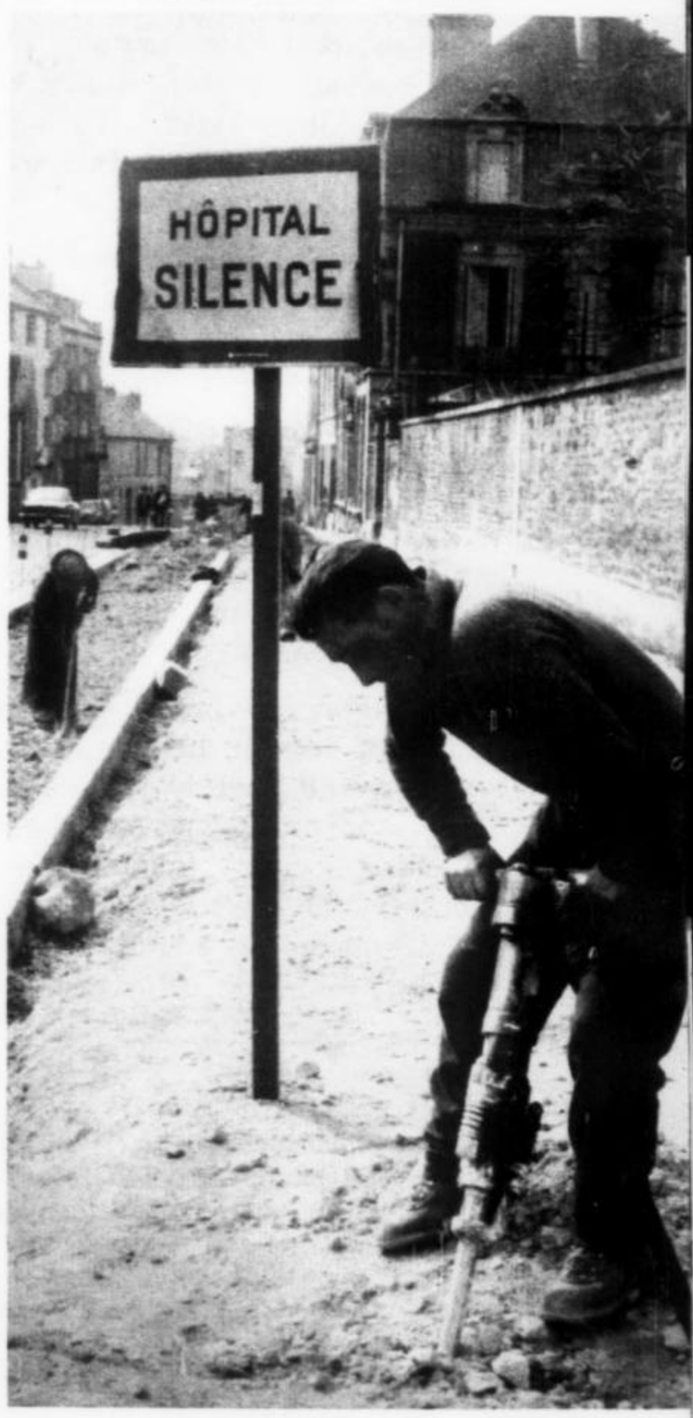
SERENADE OF THE PNEUMATIC DRILL

With their "rash" of building construction sites and street repairs, modern cities resound to the terrible clatter of pneumatic drills. Even "zones of silence" around hospitals are not spared this din (below right). People try to joke about it (below left), but the disturbance it causes has driven people to seek solutions. Above, six workers use their pneumatic drills inside a wooden shelter during an experiment to screen a London hospital from nearby road works.



"We're watching a television play. Won't you join us?"
Drawing © Aldebert.

Photo © René Maltete - Rapho



NOISE AND HEALTH

Studies have shown that continued exposure to noise not only causes damage to the ear, but can have other harmful effects

by Gunther Lehmann

PAST generations realized that noise could be disturbing, and even in the days of Antiquity there were regulations for the abatement of noise in town and homes. Though we have no precise information on the intensity of noise in, say, a Roman city, we may be sure that the farther back we go in history, the more noise was restricted to certain places; it was caused by men and animals and to only a limited extent by machines—nowadays the worst offenders in producing a disagreeable din.

Volume of noise depends on density of population and on people's activities and behaviour. It would be a mistake to regard the present increase in noise as an inevitable result of the expansion of technology. The aim of technological development should be to serve man, to make his life more agreeable and enrich it. So logically, technical progress should lead to less noise, not more.

Whether a sound strikes the ear as an annoying or irritating noise does not depend merely on its intensity; very loud music may still be beautiful whereas even minute scratching sounds can be a disturbing noise. What makes a sound a noise is a matter of psychology rather than acoustics.

A sound which we associate with something pleasurable is far less likely to be considered as a noise than one with unwelcome connotations. We always tend to underrate the noise of our own car, for example, and the children next door always seem to make more noise than our own. So whether a sound is regarded as a noise and how noisy it is depends also on who causes the noise and his relationship with the person who hears it.

A sudden, very loud noise, such as gunfire, lasting only fractions of a second, may damage a person's hearing mechanism and produce a lasting loss of hearing or partial deafness. But exposure to noise levels quite common in industry—and indeed characteristic of certain branches of heavy industry such as forging and metal cutting—leads, progressively, to "perceptive deafness," depending in each case on the intensity of the noise and duration of exposure. Once a hearing defect of this kind has set in, nothing can be done. Protective devices can help to postpone it and to slow down its development, but once the damage is done, it is irreparable.

The danger of noise-induced damage to hearing exists when noise exceeds a certain level over that of the normal auditory threshold. In assessing noise, the fact that its intensity diminishes in relation to the distance of the hearer from its source has to be taken into account. And the higher the sound frequencies, the greater the reduction.

Photo Le Fauconnier, Paris - Nord Aviation

The strain of operating a noisy machine shows in the expression of this metal worker (right). A noise level of 95 "phons" (an intensity common in certain industries) can lead to progressive deafness. Noise above this level (produced by engine test benches or pneumatic drills) can damage the hearing mechanism and even lead to complete deafness. In addition to a protective helmet and transparent mask, drill operator (above) wears ear mufflers to deaden the din from his machine.

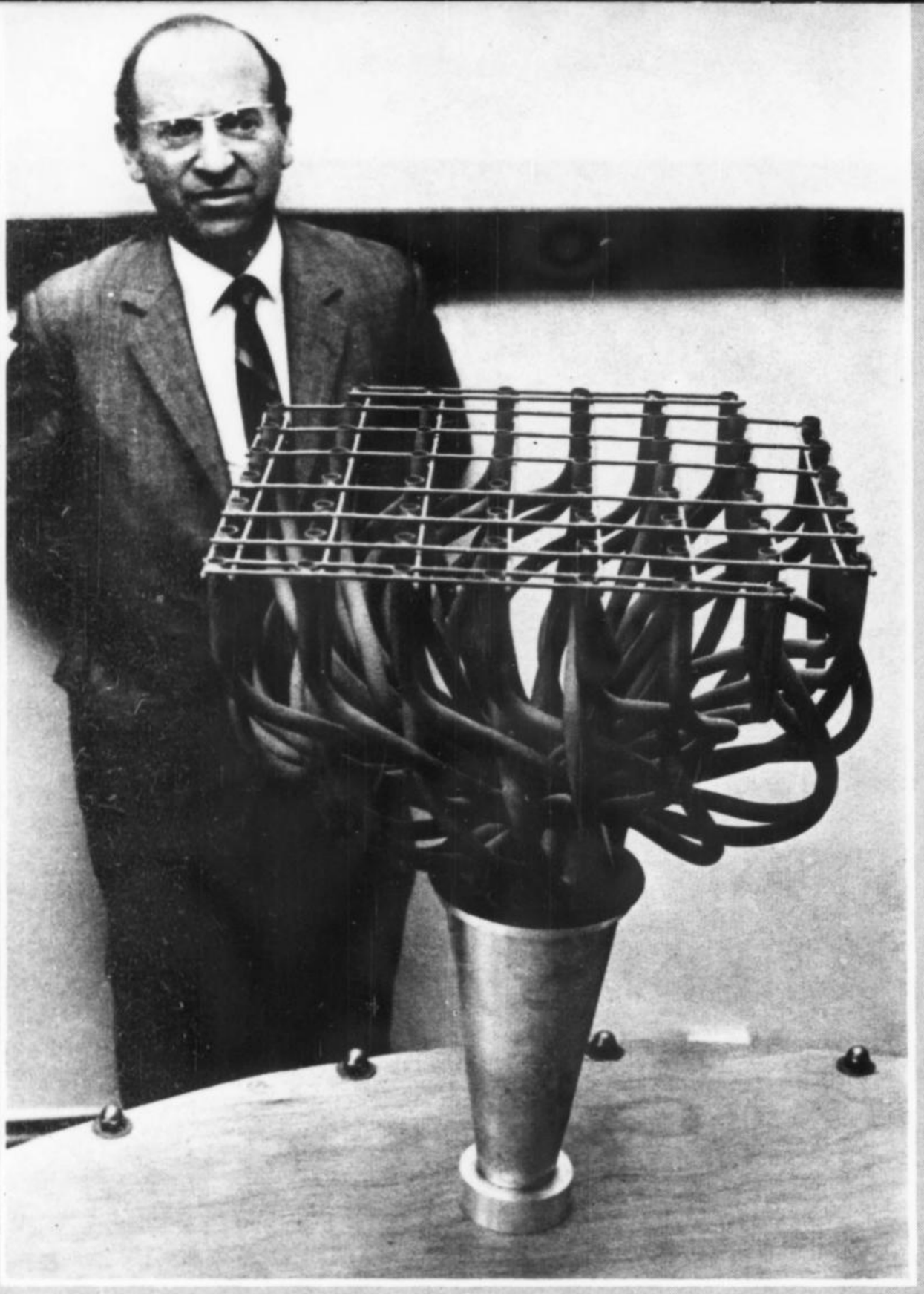
High sound frequencies, moreover, are more disagreable to the ear than low ones. Sounds produced by certain aircraft (those with turbo-prop engines for instance) comprise many high frequency tones and therefore grate on the ear. As distance increases, the high-frequency sounds rapidly fade whereas the deeper tones die away slowly.

The ability to hear high tones gradually wanes as people grow older. This is a physiological effect of aging which starts at about 45 and is often not noticed for a long time, since high frequencies are seldom heard in daily

CONTINUED ON PAGE 30

GUNTHER LEHMANN *is director of the Max Planck Institute for Occupational Physiology at Dortmund (Federal Republic of Germany) and president of the International Association Against Noise. Professeur Lehmann is a leading authority on the effects which noise can have on the human organism, and is widely known for his studies and research in this field.*

Photo © Omnia, Bern



THE DANGER OF SOUNDS WE CANNOT HEAR

Infra-sound has a pitch or frequency of below 30 cycles per second and is thus inaudible to the human ear. It can nevertheless harm the human organism. It is blamed for feelings of malaise and discomfort sometimes experienced by airplane passengers. But studies and measurements suggest that infra-sound from aircraft cannot cause physical injuries to people living near airports. Exploration of the world of infra-sound has only just begun. The French National Centre for Scientific Research has set up a special infra-sound research laboratory in Marseilles (where photos on these pages were taken). The laboratory investigates the the risks associated with infra-sound, its connexion with certain illnesses for example, and studies what practical uses may eventually be made of it.

Photos © Miltos Toscas — "Science et Vie"

ACOUSTIC BEACON. This "bouquet" of tubes in front of Professor Vladimir Gavreau, head of the infra-sound research laboratory in Marseilles, is an experimental "acoustic beacon". It can project a long-range beam of sound with great precision. The researcher behind the apparatus is in a zone of silence.

MAMMOTH ORGAN PIPE. To study the effect of infra-sound at ultra-low frequencies (3½ cycles per second) on the human organism, French scientists have built an enormous "organ pipe", 24 metres (78 feet) long. Infra-sound is inaudible to the ear but produces a fluttering sensation which results in other sounds being heard in a distorted way. Industrial cities abound in infra-sound, generated by many kinds of machines and motors that turn at a slow rate. Even infra-sound of weak intensity can penetrate houses and become the unsuspected cause of such ills as dizziness and fatigue.

DEVASTATING WHISTLE. The huge whistle shown above (similar in form to the police whistle in foreground) is a laboratory instrument. It produces an ultra-low pitched, scarcely audible sound. Working at low power it has a disturbing effect on people and makes the laboratory walls vibrate. Functioning at full blast, it would cause the building to collapse and could have fatal effects on people within a wide area. The lower a sound is pitched, the farther it carries: a police whistle (2,900 cycles per second) can be heard 500 metres away; a giant whistle with a frequency of 29 cycles per second has a range of 50 kilometres (30 miles). As infra-sound easily penetrates walls, partitions and similar obstacles, normal sound-proofing techniques are completely ineffective.

SEEN BUT NOT HEARD. Right, specialists experiment with an infra-sound detector. The inaudible infra-sound is shown visually on an oscilloscope. The threshold of hearing of the average person (about 30 cycles per second) varies from one person to another. The human voice, from deep bass to soprano tones, ranges from 80 to 4,000 cycles per second.

 (Continued from page 26)

Noise does not make the heart grow fonder

life. Noise-induced hearing defects differ from those due to ageing in that initially they are felt mostly on far lower frequencies. By testing hearing in the various frequency ranges it is thus possible to decide whether a hearing defect is due to noise or to ageing.

In almost all countries partial deafness due to noise is now recognized as an occupational disease and its victims receive financial compensation based on the extent of loss of hearing, with a maximum award for complete deafness.

Workers in the noisiest industries should obviously wear devices to protect their hearing. Unfortunately, it is not always easy to pursuade them to use these ear plugs or ear-muffs although they are neither uncomfortable nor inconvenient to wear. Apparently, the threat of a gradual onset of noise-induced deafness is not enough to encourage everyone to make use of personal protective devices.

SUCH appliances do not of course give complete protection from noise, since sounds are transmitted to the middle ear not only through the air canal of the outer ear, but also through the bone of the skull, which continues to transmit noise when the passage through the outer ear is blocked.

Even so, covering the outer ear greatly attenuates the intensity of loud sounds reaching the ear drum. In other words noise is reduced to a level at which it is no longer dangerous.

Many small easy-to-wear ear protectors have been developed in recent years. But, if bone-conducted noise is also to be blocked out, which is only necessary in the case of exceptionally loud noises, then some form of protection for the whole skull—rubber caps and helmets, for instance—is required. Such caps are used by workers checking and testing aircraft engines.

The range of hearing of the human ear is usually between 30 and 20,000 cycles per second. But only the hearing of children can reach the 20,000 cycles level. In early adult age, the threshold of hearing drops below 20,000 cycles, and for the aged the level is considerably lower. At 30 cycles, most people hear a tone not as a single regular sound, but as a series of separate beats.

In reality, comparatively few people are exposed to the danger of noise-induced deafness. Noise that has invaded every sphere of daily life may be unpleasant and irritating—the roar of traffic, for instance, or the clamour of a number of people talking loudly or shouting at the same time—but this is not likely to cause damage to hearing. Yet that does not mean those who have to listen to such noises become indifferent to them or that the problem is no concern of ours.

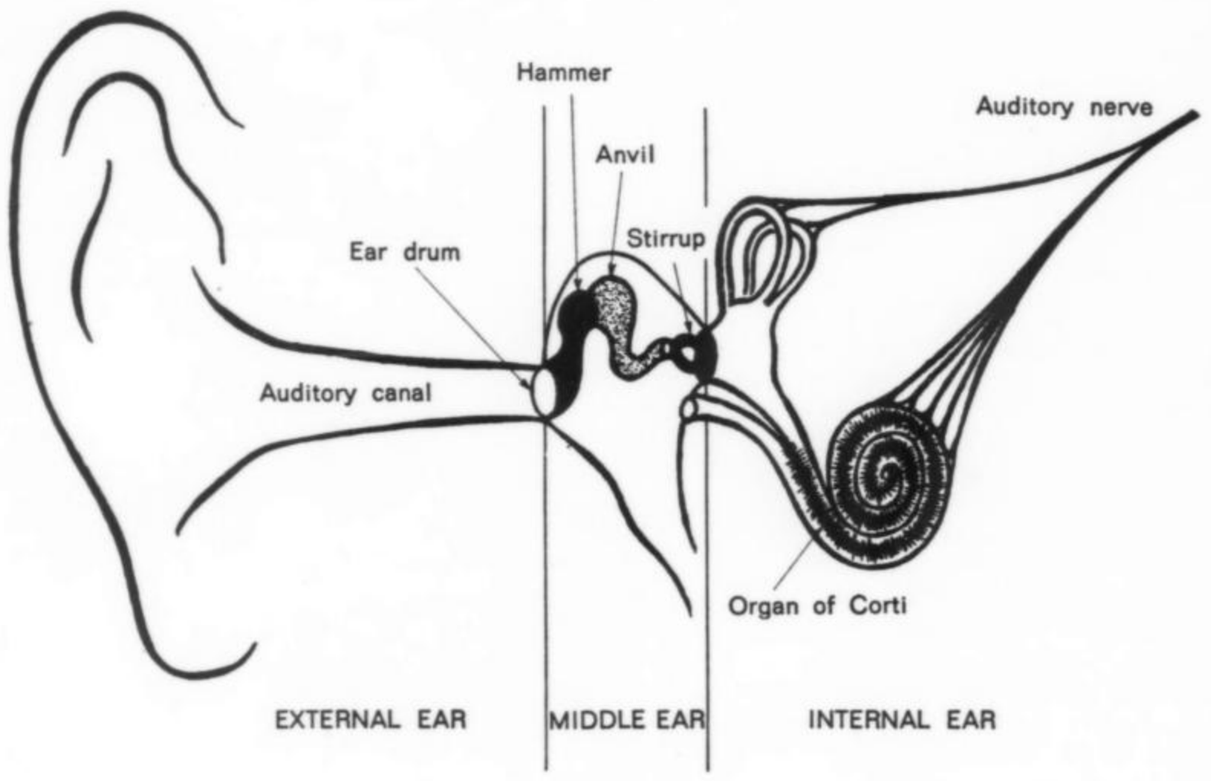
When, regretfully, we compare the proliferating noises of the modern world with the peace and quiet that once existed in some places, what we are really complaining about is the stress and nervous strain created by all the noise that assails our ears.

What threatens us is not the likelihood of auditory troubles or loss of hearing, but an incessant disturbance which, under certain conditions, creates an intolerable strain. And the amount of the strain depends not only on the intensity and duration of the noise, but also, and to a large extent, on the source of the noise and what it signifies to the person on the receiving end.

Many cases have been noted of persons becoming "acclimatized" to certain kinds of continuous or frequently repeated noise This is especially true of those willing to accept the noise because it is linked with some activity in which they are interested or which is useful or profitable to them But such cases are relatively few.

More often, especially when no particular interest in the source of the noise is present, the human response is quite the reverse, producing reactions of excitability and annoyance. These are directed not only against noise itself but are spread over a whole range of sensory impressions.

Typically, people exposed to noise of this kind easily become irritable and unsociable. Studies show that workers in noisy jobs tend to be more quarrelsome at work and away from it (at home, for example) than those doing equivalent jobs, but who are not



The ear has three parts: the outer, middle and inner ear. The outer ear collects sounds and transmits them down the auditory canal to a taut, thin membrane, the ear-drum. The middle ear, which transmits and identifies sound vibrations, is an air filled cavity bridged by three little bones, named the hammer, anvil and stirrup because of their shape. The hammer, attached to the ear-drum, vibrates with it and works with the anvil as a bent lever to vibrate the stirrup. Damage to any of these three bones can cause deafness since vibrations no longer reach the hearing part of the inner ear, the cochlea, or organ of Corti, whose job it is to transform vibrations into nerve impulses. These impulses are carrried down the auditory nerve to the brain and there interpreted as sounds. The perceptivity of the ear may be lowered by auditory fatigue (a temporary loss of hearing) or by increasing age (usually around 40). It can also be impaired by damage due to noise or disease which can result in partial or total deafness.

subject to similar noise stresses. Noise thus has a disturbing effect on social life even within the family where in most cases the father alone is exposed to noise during the day.

Scientific tests relating to the impact of noise on human beings help to explain these psychological reactions. They reveal that changes in the circulation of the blood and in the action of the heart take place when a person is exposed to a certain intensity of noise. Even snatches of loud conversation are enough to affect the nervous system and thereby provoke constrictions in a large part of the blood circulation system. These effects are maintained as along as the noise continues, but quickly subside when the noise ceases.

IMPAIRED circulation caused by the effects of noise is often revealed by skin pallor. The greater the noise and the longer it lasts, the more slowly this reaction diminishes after the noise is removed. Workers in a boiler factory, for instance, thus suffer from a constantly impaired circulation in the epidermis.

Glands and other organs subject to nervous stimulation are similarly affected. Changes occur, for example, in the secretion and composition of the gastric juices and this may eventually be harmful. Effects of this kind have been observed in workers in the iron and steel industries. But if the noise is removed the effects disappear sooner or later without apparently causing any long-term damage.

Occupational deafness of the kind found in industry sets in comparatively slowly. It may be many years before the defect becomes bad enough to worry the person concerned and still longer before it is acute enough to cause a person real embarrassment in communicating with others. But in both cases it is vitally important that steps be taken to control the genesis and the development of hearing defects.

Medical examinations of workers exposed to high noise levels are now made regularly in all countries so that anyone whose hearing has become affected can be transferred to a quieter job before the defect becomes a serious handicap. A psychologically interesting point about this is that workers are opposed to job transfers because of fear of being downgraded or perhaps earning less. No worker being examined ever feigns to be hard of hearing, but on the contrary denies or tries to conceal any defects in his hearing.

Photo © Paul Almasy, Paris

In the office, as in the factory, prolonged exposure to noise causes fatigue, absent-mindedness and mental strain. Noise has been blamed for over 50 per cent of errors in typing. Before 1939, says a World Health Organization report, office noise was costing U.S. business two million dollars a day through inefficient work. The cost today is $4 million. In office above, glass partitions isolate each worker from noise and clatter made by colleagues.

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From the Unesco Newsroom...

Kalinga Prize for French astronomer-author

Professor Paul Couderc, French astronomer and author of some 20 popular scientific books has been selected as the fifteenth winner of the international Kalinga Prize for the Popularization of Science. A former secretary-general of the French National Committee for Astronomy, Professor Couderc was responsible for installing the platenarium in the Paris scientific museum, "Le Palais de la Découverte". His popular scientific books, which have been widely translated, include an explanation of the theory of relativity, which sold nearly 100,000 copies. The Kalinga Prize is awarded annually, by international jury appointed by Unesco.

U.N. Development projects in 113 countries

During 1967-68, more than 6,000 specialists will be taking part in technical assistance projects financed by the U.N. Development Programme and carried out in co-operation with U.N. Specialized Agencies in 113 countries. Grants for training and study will be given to more than 8,000 people in these countries.

Trailing the locust

Special surveys of potential breeding areas of the desert locust in Iran and Afghanistan began recently. The work is being paid for by the U.N. Development Programme which has already financed similar surveys in Africa and Saudi Arabia. India is now reported to be virtually free of locusts, but single insects are still found in possible breeding places, and if not rapidly detected the desert locusts can multiply into a plague.

Sweden's switch from left to right-hand driving

Elaborate road safety plans are being made in Sweden for the planned change-over from left to right-hand driving which becomes effective at 5 a.m. on September 3, 1967. Just before the change-over, severely reduced speed limits will be put into effect, and all but emergency vehicles will be banned from the highways for four hours before and one hour after the change-over.

Problems of oil pollution on the seas

The Council of the Inter-Governmental Maritime Consultative Organization, meeting in London to consider problems of marine pollution by oil, has recommended a number of studies to prevent similar accidents to the one which recently caused large areas of the English Channel and French and British beaches to be polluted with oil. One will concern the establishment of mandatory sea lanes for tankers and similar vessels and another will look into the possibility of equipping these ships with special navigational aids. Research will also be stepped up on the prevention of pollution by mechanical and scientific means.

Teachers give up their holiday—to teach

As in previous years, a number of British teachers and lecturers will give up their summer vacation this year to run staff refresher courses for teachers in developing countries. In 1967, 150 will leave for 15 countries where some 2,000 local teachers are expected to benefit from refresher courses.

Will man make the weather?

Methods of large-scale weather modification—such as the diversion of warm ocean currents, destruction of the Arctic snow cover, and damming of the Bering Straits will be possible within about 20 years, according to Evgeny Fedorov, Director of the Hydro-Meteorological Institute of the Soviet Union. Addressing delegates to the recent Fifth World Meteorological Congress, meeting in Geneva, he said that man already exerts considerable influence on the composition of the atmosphere. The lower atmosphere is being heated through combustion products and industrial pollution, and moisture circulation is being changed by land improvement and other surface changes.

Natural encyclopaedia

The Forestry Service of the Harz Mountains, in conjunction with teachers at Sieber (Federal Republic of Germany), has created a "forest encyclopaedia". Over a distance of 2 1/2 miles, signs identify the various species of trees and explain their life cycle. Other signs give facts about birds. An "ornithological clock" indicates the hour at which they wake—redstart: 4.40 a.m.; cuckoo: 4.30 a.m.; blackbird: 4.40 a.m. and so on.

Subsoil satellite

An orbiting geological laboratory is being planned in the United States. One hundred miles (160 kilometres) out in space, it will measure heat radiations and magnetic properties of the land below so as to help locate the natural resources of the world. Similar techniques might be used to make a geological chart of the moon and planets.

Sunlight telephone

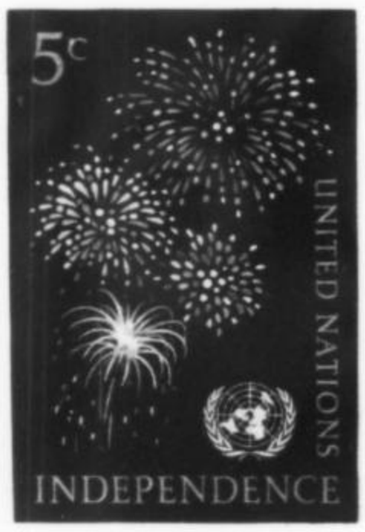
Transistorized solar radio-telephones for the use of motorists have been set up in Ghana on the road from Accra to Tema. The sun's rays are collected through a panel of photo-electric cells mounted on a mast, and the current produced is sufficient to keep a battery charged. Five such radio-telephones can operate on 1 watt, and the equipment is inexpensive.

Gas cutlets

Two British scientists have perfected a method of extracting protein from natural gas. The protein is derived from methane and takes the form of a white, flakey substance. Ten tons of protein could be obtained from 56,000 cubic metres (353,000 cubic feet) but the cost is very high. Efforts to produce synthetic protein from oil have been under way in France for some years.

A watch on air pollution

Creation of a network of air pollution control stations in Western Europe was proposed by a recent international conference in Stockholm sponsored by the Swedish Comittee for Air Purification. The stations would study soot and sulphur dioxide content in the air—the most common industrial pollution—the spread of air pollution over unpopulated areas and the long-term changes in Europe's atmosphere due to rapidly increasing industrialization.



INDEPENDENCE CELEBRATIONS

A multicoloured fireworks display is depicted on this "Independence" stamp issued by the U.N. Postal Administration to pay tribute to the 55 countries which have achieved independence since the United Nations was founded in 1945. The United Nations has played a significant role in this progress and its membership has increased nearly two-fold as a result, today totalling 122 countries. As agent in France of the U.N. Postal Administration, Unesco's Philatelic Service stocks all U.N. stamps and first day covers currently on sale. For further details write to the Unesco Philatelic Service, Place de Fontenoy, Paris (7e).

INTERNATIONAL TROPHY FOR SPORTSMANSHIP

The annual Pierre de Coubertin International Fair Play Trophy (for 1966) was presented to wrestler Stevan Horvat of Yugoslavia by Mr René Maheu, Director-General of Unesco, on April 18, at a ceremony in Unesco House, Paris. Horvat (left) received the award for his sportsmanship during the world championships in Greco-Roman wrestling at Toledo, Ohio (U.S.A.) in June 1966, when he appealed against measures which would have hindered the chances of his opponents. The measures were not taken and Horvat had thus to face his strongest competitors. Despite this he went on to win. The International Committee of Fair Play Trophies also awarded a diploma of honour to an American sailing team for their sportsmanship during the international challenge round of catamarans at Thorpe Bay, Great Britain in September 1966. The American crew agreed to allow their British competitors to make certain repairs to their boat, although the interpretation of the ruling was questionable. This gesture enabled the British team to win the finals.

Averting nuclear accidents

A system for the protection of nuclear centres in the event of seismic disturbances has been devised in Japan. Should a reactor be put out of order by an earthquake, the control devices might become incapable of stopping the chain reaction by absorbing the neutrons. In the new Tokai Mura atomic centre, the reactor has been fitted with hoppers containing four million balls made of steel mixed with boron and measuring 2 mm in diameter. Three seismographs continuously record the vibrations of the soil and should these reach a certain intensity, they release the balls into the heart of the reactor, thereby ensuring that the neutrons are absorbed and that the reactor comes to a stop.

Electronic library service at computer speeds

The first system of automated documentation for nuclear science and technology has come into service at the Euratom Information and Documentation Centre in Brussels. This service enables over 400,000 books, reports and articles to be found in the "twinkling of a computer's eye" and made available to researchers and manufacturers. Each year at least 100,000 new documents will be added to this computerized library.

African wildlife charter

A convention designed to save African wildlife threatened with extinction has been proposed by a meeting of African countries at Fort-Lamy, Chad, organized by the Food and Agriculture Organization. It was drawn up by delegates from 20 countries and several international organizations, including Unesco. When adopted it will give complete or partial protection to more than 100 species, ranging from lion to wart-hog, giraffe to crocodile, many of which are already endangered by indiscriminate hunting or by destruction of their natural habitats. Other proposals to protect wildlife include stricter control of the sale of trophies in which a flourishing black market exists. Ratification of these proposals and of the convention itself will be considered by an international African conference to be called by the Food and Agriculture Organization early next year.

'The World of Music'

The first issue of "The World of Music", a magazine published by the International Music Council and Unesco, has just appeared. This tri-lingual quarterly (English, French and German) aims to give readers an overall view of the different conceptions of musical language and to contribute to a better understanding of musical values. Eminent music critics, musicologists and composers have contributed to the first issue, which has articles on "Total Theatre", "Improvisation in Indian Music" and "Unesco and Music". "The World of Music" is edited in collaboration with the International Institute for Comparative Music. For Great Britain and the Commonwealth, subscriptions should be sent to Bärenreiter Ltd., 32/4 Great Titchfield St., London, W.I. (28/-) or (for the U.S.A.) to Bärenreiter-Verlag, Heinrich-Schütz-Allée 31-37, D-Kassel-Wilhelmshöhe, Federal Republic of Germany ($6.00).

Great modern sculptors

"Rodin" is the latest in a series of monographs on the great sculptors of modern times published in English and French language editions by Arted, Editions d'Art (6, avenue du Coq, Paris-9e). Prepared by Professor Ionel Jianou and Cecile Goldscheider, Curator of the Rodin Museum in Paris, the monograph presents a comprehensive study of Rodin's life and work, including a chronology, a list of exhibitions, a bibliography and commentaries. The Rodin monograph has 208 pages and 90 photographs and costs 75 F. Previous volumes in the series were devoted to Brancusi, Zadkine and Bourdelle.

Flashes...

■ *Vast areas still have only one doctor for 50,000 people and over most of the world there is hardly a doctor for 10,000 inhabitants, reports the World Health Organization.*

■ *The 18th International Astronautics Congress, organized by the International Astronautical Federation, will be held in Belgrade from September 24 to 30, 1967.*

■ *Unesco and Unicef (the U.N. Children's Fund) are now jointly running some 70 educational programmes concerned with teacher training and instruction in health, nutrition, home economics and community development.*

■ *Tanzania has opened its first youth hostel at Kinondoni, near Dar-es-Salaam.*

■ *The Soviet Union has over one and a half million women teachers and headmistresses—69 per cent of the total teaching profession.*

BOOKSHELF

UNESCO BOOKS

■ **Planning for Health Education in Schools** (Unesco Source Book)
A study by Prof. C.E. Turner for Unesco and the World Health Organization.
Co-edition : Longmans, Green and Co., London - Unesco, Paris 1966 ($2.50; 12/6 stg.; 9.50 F). Bound ($3.50; 17/6; 12.50 F).

■ **New Trends in Chemistry Teaching**
Volume I (1964-1965)
Edited by E. Cartmell.
(The Teaching of Basic Sciences), 1967 ($7.00 ; 35/-stg. ; 24 F).

■ **Adult Education and Television**
A comparative study in Canada, Czechoslovakia and Japan.
Edited by Brian Groombridge.
National Institute of Adult Education in England and Wales in collaboration with Unesco, 1966 ($4.50; 22/6; 16 F).

■ **An Asian Model of Educational Development: Perspectives for 1965-80,** 1966 ($2.00 ; 10/-stg. : 7 F).

■ **Economic Development and the Programming of Rural Education**
By L. Malassis. 1966 ($1.25; 6/-; 4 F).

★

■ **Unesco : 20 Years of Service to Peace (1946-1966).**

■ **Unesco: Twentieth Anniversary of the Organization (4 November 1966).**
Speeches and Messages. English, French, Spanish, and Russian language editions.

Both publications available free of charge from Public Liaison Division, Unesco, Place de Fontenoy, Paris-7e.

★

■ **Society Today and Tomorrow**
Readings in Social Science.
Edited by Elgin F. Hunt and Jules Karlin.
The Macmillan Company, New York ; Collier-Macmillan Ltd., London; Second Edition, 1967.

■ **Adult Education in France**
By Colin J. Titmus
Pergamon Press, Oxford 1967 (42/-stg.).

■ **Sweet Malefactor**
Sugar, Slavery and Human Society
By W.R. Aykroyd. Heinemann, London, 1967 (30/-stg.).

■ **History of the Motor Car**
By John Ray. The Commonwealth and International Library, Pergamon Press, Oxford, 1966 (15/-stg.).

■ **Japanese Architecture**
By Hideto Kishida (Tourist Library, Vol. 6), 1961 ($2.50).

■ **Japanese Handicrafts**
By Yuzuru Okada. (Tourist Library, Vol. 21), 1962 ($3.25).

■ **Japanese Gardens**
By Matsunosuke Tatsui (Tourist Library, Vol. 5), 1962 ($1.75).

Three volumes published by the Japan Travel Bureau, Tokyo. Available through Charles E. Tuttle C., Rutland, Vermont, U.S.A.

Letters to the Editor

DON'T CHANGE YOUR POLICY

Sir,

You have been printing so many letters asking you to change your editorial policy, that I feel constrained to write.

Other publications cater for different parts of the community, but there is no other magazine quite like the Unesco Courier—do not change it at all; it caters for the intelligent of all ages. It makes people aware of the world, it makes one feel a citizen of the world. My sister is 12 years old; she reads those articles that catch her eye, and I see from your "Letters to the Editor" column that your oldest readers live in old-age homes.

The Unesco Courier can change one's whole outlook on what one should be doing with one's life. Its influence is immense and I expect diverse: but let me illustrate with my own experience.

I have been getting the Courier since 1964 and in 1966 its influence had worked on me to such an extent that I threw aside those qualifications I had gained in four years at university and started studying sociology and subjects as background to sociology. My expectation now is that I might make a small contribution to the science which will make a large contribution to men's happiness; but my hope (note sociological distinction between expectations and aspirations), my hope is that I might make a contribution to peace research itself.

Whenever I see suggestions to make the Unesco Courier "better" for a special interest group I am horrified. It should appeal to everybody, and its present policy of making people aware of what is going on in the world today, and what has gone on in the past seems, to me, ideal.

Perhaps I am biased because its influence has been so great in my life, but if it could influence me to that extent, perhaps it also influences others.

A reader
New Zealand

Our reader has asked that her name be omitted—Editor

TALLEST TELEVISION TOWER

Sir,

In your issue of November 1966 (page 33) I read that the Moscow Television Tower, when completed in the autumn of 1967, will be the highest edifice in the world, 520 metres or 1,700 feet in height.

Actually, however, there are several taller television towers in the United States. They include KTHI-TV, in Fargo, North Dakota (2,069 feet); KSLA-TV, Shreveport, Louisiana (1,791); WRBL-TV, Columbus, Georgia and WBIR-TV, Knoxville, Tennessee (1,749 feet), according to "Television Factbook", nº 36, 1966.

It may be that the Soviet statement pertains to a *self-supporting tower:* the tallest self-supporting tower in the Western Hemisphere is that of WITI-TV, in Milwaukee, Wisconsin, which is 1,078 feet high.

Burton Paulu
Dept. of Radio and Television
University of Minnesota, U.S.A.

ART AND LIFE AS ONE

Sir,

At all times art stands for the dignity, the interest and the horizon of life. I disagree with readers (April 1967 issue) who ask you to devote less place to it in the Unesco Courier. In my view, your remarkable magazine never neglects the other aspects of its far-reaching aims and purposes.

Madeleine Louis Cazamian
Paris, France

HUNGRY, BUT NOT FOR ART

Sir,

I agree with readers who say you publish too much on art (April 1967). The articles which interest me most are those that present the major problems of our time and explain what is being done to improve living conditions in the developing countries. What is the use of talking about art to the two thousand million people (out of a world population of 3,000 million), who are starving?

G. Perra
Lyon, France

CULTURE HAS NO FRONTIERS

Sir,

I have just seen your January 1967 issue. Nothing could have been more graphic than your presentation of the havoc wrought by the floods to these art treasures in Italy. One feels distressed at the thought of the uncontrolled forces of nature letting themselves loose on these masterpieces. I do hope that your appeal will succeed and whatever could possibly be done to restore these paintings, manuscripts and statues will be done.

I think that Unesco's role in preserving the great Egyptian monuments and now the campaign to save these Italian treasures is doing much to bring the world closer together. Which shows what culture can do to remove the national barriers which politics is trying all the time to build up.

Mumtaz Hasan
Karachi, Pakistan

ST. JOHN THE EVANGELIST

Sir,

May I say how much I admire the quality of the colour pages in your April 1967 issue. There is however an error in the caption at the bottom of page 23: "Far left, John the Baptist, an early 15th century window..." This figure is John the Evangelist whose symbol is the eagle.

Annunciata McWalter
Dublin, Republic of Ireland

ETHICS IN THE MASS MEDIA

Sir,

"The Intruders" by René Maheu, an article which takes a look at ethics in the mass media (February 1967), deserves the widest and most attentive study.

All the technological and cultural revolutions in the world will never change the fact that the flowering and durability of a civilization depends above all on the moral and spiritual worth of the individual. The individual is the cell of the social tissue and if this cell becomes weak or diseased, the tissue as a whole will perish sooner or later.

The "manipulators of news and information", whose possibilities of action have increased out of all proportion to the audience they now reach, have a major responsibility in keeping the "individual social cell" in good health.

If they themselves are unable to draw up a Code of Honour, it is the imperative duty of the authorities to provide them with one in a legal form that could be recognized by the courts.

Jean Mar
Niort, France

FIRE, A ZOROASTRIAN SYMBOL

Sir,

Your article about Iran (December 1966) refers to the "Zoroastrian fire worshippers". The Zoroastrians do not worship fire. They worship Ahura Mazda who is the Great God. The fire is an element very much respected by the Zoroastrians because it lights the darkness and destroys evil. Fire is to the Zoroastrians as the cross is to the Christians, a symbol. Calling the Zoroastrians fire worshippers is like calling the Christians cross worshippers, an unfair and untrue interpretation of the religion.

M. Behesht-Nejad
President, the Iranian
Students Association
Portland, Oregon, U.S.A.

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(see page 13)